THE

ELECTRICAL REVIEW.

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THE BRAY EXPLOSION.

INFORMATION is now available with regard to the recent disastrous explosion of a compressed-air reservoir at Bray, Ireland. In a Diesel engine plant there are starting reservoirs of compressed air which need not contain what we may term the Diesel pressure of 500 lb., and there are fuel injection cylinders of compressed air which may carry a pressure as high as 800 lb., so as to furnish air capable of injecting oil into the compressed air in the engine cylinder at 500 lb. Sometimes it may happen that these air stores become depleted, when, according to the makers' instructions, they may be recharged with carbon dioxide gas *or oxygen*, bottles of which are usually on sale containing the gases at very high pressures. It appears that at Bray on July 7th the starting air was lost, and it was made good from a 40-ft. oxygen cylinder to a pressure of 350 lb., and at the same time the pressure in the blast cylinder was raised from 350 lb. to 700 lb., so that apparently this reservoir had also been depleted.

The information to hand does not make it clear whether the starting reserve was very far run down, for, though it is said that the starting air was lost, only "a little" oxygen was let into one of the starting receivers. It would then contain an air very rich, at least, in oxygen and capable of producing more than usually violent combustion. It seems certain, however, that the blast reservoir pressure was doubled by addition of oxygen, and therefore, in place of atmospheric air with one-fifth its volume of oxygen, there was a mixture containing about six-tenths of its volume of oxygen; this, shooting into an already richly oxygenated air, would produce very rapid combustion of the sprayed fuel, and possibly, but for the Diesel principle of protracted fuel entry, there might have been worse results. Mr. McDonnell's report, which we print elsewhere in this issue, states that the fuel valve on the cylinder of the engine exploded, and the flame "burst along the blast pipe" and reached the blast receiver, which *then* (*sic*) also exploded. But if the receiver had contained nothing but oxygen, it should not have exploded.

Are we to infer that when the fuel valve burst it only burst internally, and that the explosive and flaming blast carried some oil forward to the receiver, where it was exploded by the oxygen? It must have been burning, or how could the oxygen cause explosion?

Messrs. Ross and Lilly speak of the enormous pressure that would be generated in the engine cylinder, the ignition, by the flame, of fuel at the fuel valve, and the transmission of the explosion to the blast air receiver, which exploded—"probably due to a rich mixture of nearly pure oxygen and oil vapour in the cylinder." But again, this is no explanation. How came there oil vapour in the receiver? Its presence seems to be taken for granted, but not a word is said as to how the oil got there. This receiver never should have oil vapour in it, but this report reads almost as though its authors regarded the oil vapour as properly there,

and the oxygen as the dangerous interloper. Without excess of oxygen the oil might be exploded; without oil the oxygen would be as inert as nitrogen.

The report of the National Boiler Insurance Co. informs us that "the explosion consisted of the development of explosive energy"—a truly marvellous explanation, but little satisfying—"apparently . . . owing to the combination of the oxygen in the blast receiver with oil in the receiver or its passages." Again the assumption of oil, without any comment on its presence or any hint as to the wrongness of its presence.

Without a personal examination of the wreck, of the details of design, and of the general arrangement, it is not possible for us to say with confidence how the oil did get into the high-pressure air receiver, if it really was there.

It is stated that oil may get into the air receivers from the air compressors, being carried over as vapour by the air which, of course, is hot as it leaves the compressor. But it is not likely that it would remain vaporous in the cool receiver. It would condense again, and certainly in the present case it is unlikely that oil vapour was present, for the receiver was not filled from the compressor, which had been standing with the engine. The fuel used at Bray has been crude Texas oil, but paraffin was used at times of starting up after long stoppages or dismantling.

Had the fuel valve burst into the atmosphere it would have let out the contents of the receiver; the cylinder pressure could not then have blown oil against the 800-lb. pressure. So let it be assumed or admitted that the heavy pressure in the cylinder destroyed the fuel valve internally and left an open pipe between the cylinder and the blast air vessel. This open pipe was fatal. Granting that flame and oil were forced into the receiver, this would be ample to account for the explosion. Even if flame alone reached the receiver, the heat addition would raise the pressure in this, and it might explode.

The root cause of the trouble was undoubtedly the oxygen. If blast-furnace gas, which will hardly burn under a steam boiler, will ignite certainly, regularly and explosively, when under compression in an engine, will not compressed oxygen be also far more energetic than when at atmospheric pressure? Even without pressure beyond the atmospheric, oxygen is far more active than air, which is a 20 per cent. mixture only with nitrogen.

Surely oxygen was a dangerous gas to employ as a starting medium. The engine cylinder, if oxygen was so used, ought to have been allowed to make one exhaust stroke before fuel was admitted. The fuel should only have been admitted into air. Let it be allowed that the cylinder pressure depends upon the amount of oil injected, and that the protracted injection prevents explosion, and that there is only continuous burning; then an excess of oil would consume all the oxygen contained in a cylinderful of air. But, given a cylinderful of oxygen or of an over-rich mixture of oxygen, and combine with this an excess of oil—the pressure that would ensue would be disastrously high and might well burst through the fuel valve and send flame and oil into the high-pressure receiver, there to do further mischief. The oil sprays into a Diesel cylinder are not copious, and therefore a little extra oil might mean much by way of high pressure in a rich atmosphere. Then, again, is there information as to the condition of the cylinder in respect of lubrication? Engineers in charge are very prone to flood a cylinder with lubricant at the time of starting. With a hot oxygen flame and plenty of surplus oxygen, may it not be fairly inferred that such excess of lubricating oil could do the mischief by burning in the presence of hot oxygen?

While the fundamental cause of the trouble was apparently the use of oxygen, it is very probable, as indicated above, that this alone could not have caused excessive pressure in the engine cylinder. A definite charge of oil only contains so many heat units, and the oil only enters the cylinder as the piston moves, and can only cause so much increase of pressure of the charge, whether that be air or oxygen. This seems to be indisputable. There must, therefore, have been an excess of oil forced into the cylinder, and owing to the unfortunate coincidence of an excess of oxygen, more heat units were generated; the pressure became excessive, the fuel valve failed, and, driving a plug of oil in front of it, the flaming blast rushed into the blast vessel, where the plug of oil was violently sprayed and ignited by the following flame, in this vessel containing 60 per cent. oxygen.

The moral is that oxygen, perhaps safe enough under the normal conditions of a small oil injection, contains serious elements of danger when fuel conditions are abnormal, and it should not be used. Carbon dioxide gas does not appear to have any such risks; indeed, an engine might hardly be expected to make a start with it until at least one exhaust stroke had cleared the cylinder and allowed air to enter for compression as the working charge. As engines of the Diesel type become more numerous it may be expected that bottles of compressed air will become available for charging empty receivers. The users of Diesel engines can hardly be blamed, for makers are usually very chary of exposing their wares to improper stresses; but they should now be warned against such uses of oxygen.

In view of the liability of losing the air store of a Diesel plant, it seems desirable that there should be some small independent air compressor for recharging purposes, such compressor to be driven by a small gas or petrol engine, an easily started oil engine, or by an electric motor from a storage battery or other reliable source.

Another point that may be put is that between the engine and the blast air vessel there ought to be placed, in the course of the blast air pipe, a reflux or retaining valve which would prevent the possibility of any blow back into the blast vessel. Had such a valve been present at Bray the air vessel would not have exploded. But even had this air vessel not burst, the destruction of the fuel valve might have permitted an excess of oil to reach the engine cylinder, and there might still be risk of destroying the latter. Thus, no matter how the blast air vessel may be safeguarded by a retaining valve, this will not safeguard the engine, and therefore oxygen ought not to be employed.

Incidentally, engineers in charge of Diesel plant might with advantage satisfy themselves that oil cannot creep by gravity from the fuel valve to the blast air container. If there is a fall to the container, there should be a sump in the course of the blast pipe with a pet-cock for discharging such creep.

In conclusion, we are writing after the event, and we wish to make it clear that our remarks are not intended to cast any reflection whatever upon the management of the Bray electricity works. Mr. Sowter, who has sustained so shocking a misfortune, was acting upon the instructions of the makers of the engine, and cannot be held responsible for the accident. Our aim is rather to prevent a recurrence of such a disaster than to reproach anyone for its occurrence.

Wasteful Controversy: An Appeal to Both Sides.

For several years past the electrical industry in some of its sections has been as a house divided against itself. Rate-aided competition with the private electrical contractor compelled the latter to strengthen his organisation, and scour the country establishing a fighting fund with which to fight supply station engineers and their committees, contest the legality of municipal operations in the Courts, and so on—and with what result? The supply authorities fighting with public money for the maintenance of departments which were calculated to injure the private trader, and for the securing of further powers, have had to eat

humble pie. Not only the spirit of the contractor and ironmonger, and all other trading interests dependent upon the initiative of the private business man, has been active in its nostility, but the Courts have decided against undue trespass upon private ground, and in Government quarters there is no sympathy with excessive municipal ambition. As we have said again and again, the ambitions of the supply engineer are easily understood in these days when commercial development is an imperative necessity, and we can quite understand that the failure of a contractor to show enterprise in a district might hamper the electricity supply department, but, these things notwithstanding, we shall deplore the dawning of the day when the mere desire for success of a public department shall be allowed to trample on the fundamental principle of the rights of the private trader. We have no desire to repeat the old arguments with respect to this question. Our readers are not strangers to our policy—we have expressed it plainly in respect of the Leicester case, and on other occasions, and we have urged repeatedly for the putting an end to this disagreement in the interests of the whole industry. Surely there are amongst us, either in the sections concerned, or else acquainted with them, though not actively engaged therein, men who can sit down and dispassionately and judicially define the legitimate sphere of the contractor under a given set of circumstances, and the legitimate sphere of the supply authority. We doubt whether this quarrel will ever be permanently settled by the contractor or by the supply man without the assistance of some other party. Compromise and co-operation there will have to be, but we are inclined to doubt whether, after all that has passed, the two parties will, in conference, be able to draw up a scheme acceptable to both sides, for the good of the industry, and likely to receive the sanction of Government departments. Each side has its own ends to serve, and give and take are inevitable, but a strong and diplomatic presiding genius is needed to hold the balance. The subject has been threshed out till everybody is weary of it. Let there, then, be a renewed effort on the part of both contractors and supply men to "come together" in regard to main points and let them enlist the assistance of some public-spirited independent mind as an arbitrator or as a guide, so that we may have peace in the interests of the entire electrical industry, not constant internecine wasteful strife between sections, which really is good for nobody. The time is ripe for action. The Courts have shown that in cases municipalities have exceeded their powers, a Parliamentary committee has given its decision, as reported on another page to-day, on the side of the contractor, and the I.M.E.A. further powers Bill is not forward at present. We suggest, then, that the conference, which a year or so ago met in London, and from which some of us expected so much, but which ultimately dispersed without any good result, should meet again immediately the holiday vacation is passed, in the hope that a new serious determined effort may be made, so that the wound may be permanently healed and the wasting process may terminate.

Copper. In commercial circles the views of the producer must still have weight, in spite of the modern doctrine that administration belongs to the consumer—the non-productive consumer for choice. It is, therefore, interesting to note the *résumé* of the copper position given by Major F. Johnson, chairman, at the meeting of the Falcon Mines, Ltd., held on August 1st. This gentleman considered that the world's output of copper had far from kept pace with the ever-increasing demand, and pointed out, in support of this theory, that, whereas 15 years ago the total output of copper was under 400,000 tons, and the price (average for the year) was only £49 10s., yet in 1911, with more than double the output the average price was £55 16s. Again, during the 10 years 1890 to 1900 the average price of copper was £50, while for the 11 years to the end of 1911 the average was over £65, and for the present year the average has been over £70, and this is not remarkably high, comparing it with the £86 10s. averag for the two years 1906-7. The encouraging inference (for the electrical world) was drawn that frequent strikes amongst railway and transport workers will hasten the conversion of railways to electrical working. Increased knowledge of the earth's surface was instanced as rendering the discovery of more high-grade mines less likely.

The conclusion to which the chairman of the Falcon Mines arrived was that the prospect of a permanent reduction in the price of copper is remote, and that all indications are in favour of a maintenance of the present rate. The deduction that railway electrification will be hastened by coal strikes appears perfectly sound, especially in countries where water-power is available. If, however, the price of copper, which would also be affected by transport strikes, should rise to inordinate heights, the question of aluminium conductors would enter into the financial considerations so far as transmission is concerned.

South African Progress. Engineering changes are proceeding at a considerable pace in the Rand district of South Africa. In the gold-mining industry low working costs and maintenance charges are everything, and during the past year the change from steam to electric winding has practically been completed, the power being obtained either from the power company or the mine generating plant.

According to Mr. F. H. Davis in his valedictory address as President of the South African Institute of Engineers (published in the *South African Mining Journal*), the fears which were entertained by many as to the effect of the change have proved groundless, and the users find that they can get results with the electrical winders which they were unable to secure with the older system of working. The plan of granting certificates after examination for efficiency either as electrical or mechanical engineer is now in full force. As three certificates are compulsory before employment can be given in responsible positions, the result is that a higher standard of competency has been reached with correspondingly improved efficiency. This is seen all round, not alone in electrical developments but also in the intelligent use of compressed air, which is now being distributed from central points to the various mines on a metered basis just like electrical energy. Hot bearings and minute leaks are now sought for, and at once eliminated—a welcome change from old-time methods. Another direction in which progress is being made in the Transvaal is in the establishment of iron and steel works. One such is already in successful operation, turning out 20 tons of finished products per day. Rounds, squares, flats and angles in both iron and steel, as well as rails weighing up to 20 lb. per yard, are now being manufactured locally, so that it may not be long before home exports of these articles are affected.

In view of the Johannesburg municipal gas engine fiasco, and the consequent set-back in local confidence in this method of utilising energy, it is noteworthy that a 400-H.P. producer gas plant has been installed at the Groenfontein Tin Mine. It has been at work for some months, and is giving the very best results, vindicating to a great extent the reputation of the gas engine in that district. This plant uses all classes of local bituminous coal, and is probably only the first of many such installations.

Altogether the past year bears witness to the engineering ability at work in the Rand district of South Africa, and the results justify the optimism as to the future which is apparent on all hands.

Newcastle-under-Lyme Electricity Supply. — In presenting the annual report of the Electricity Committee to the T.C., Alderman Myott stated that a profit of £535 had been made. The Committee had wiped off all capital expenditure other than that sanctioned by the L.G.B., and had also some money in hand towards proposed extensions at the works.

The T.C. has reduced the price of current for power as under:—Up to 2,500 units per annum, 2½d. per unit; 2,500 to 5,000, 2d.; 5,000 to 7,500, 1¾d.; 7,500 to 20,000, 1½d.; with a discount of 5 per cent. for 10,000 units and over.

ELECTRO-HYDRAULIC POWER FOR STEERING VESSELS.

The application of electric power to steering gear, in order to dispense with steam auxiliaries entirely, has received the attention of many firms interested in ship design. One of the latest achievements in this direction is the equipment of the steamship *Orama* with an electro-hydraulic steering gear made by Messrs. John Hastie & Co., of Greenock, according to the Hele-Shaw-Martineau patents. This gear is the result of experiments which have been carried on for the last seven years, and one of the conditions which the makers lay down as being essential to reliable operation is the use of a continuously-running electric motor, protected from shocks upon the rudder from the sea, which transmits its power by means of a pump and hydraulic cylinders attached to the rudder stop. The pump has to be so arranged that its flow can be instantaneously stopped or directed by the steersman to either of the hydraulic cylinders operating the rudder. It is claimed that gear of this description combines reliability with great economy of running cost over other forms of gear. In steamers where a lighting set is at work all day, the extra

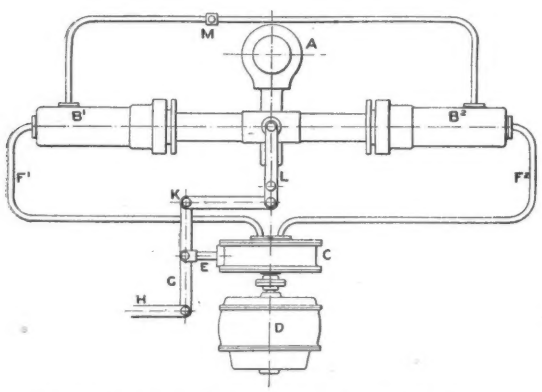


Fig. 1.—Diagram of Hele-Shaw-Martineau System.

steam required for the steering power is imperceptible. The gear gives extreme sensitiveness and quickness of action, enabling a very straight course to be steered, which indirectly saves coal to the ship; there is also great economy of space, combined with simplicity of construction, and the gear is not noisy in working. Fig. 1 shows the general lay-out of the gear; A is the tiller fixed to the rudder stop, and B_1 and B_2 are the hydraulic cylinders and ram operating the tiller by means of the cross head; C is the specially devised Hele-Shaw pump driven continuously by the electric motor D; E is a spindle controlling the operation of the pump, and this is so arranged that in its mid-position no flow of liquid takes place, although the pump is running. If it is pulled out from the pump, liquid is drawn from pipe F_1 and cylinder B_1, and propelled down pipe F_2 to cylinder B_2. If the spindle E is pushed in, a reverse flow of liquid takes place. G is a floating lever coupled at about its middle point to the spindle E while H is connected to the control shaft or telemotor, this connection being fixed at one end to the lever G whose other end is connected at K to the tiller through the medium of lever L. It will therefore be seen that when H is moved it moves G and the spindle E and liquid flows at once to one ram, and the rudder is operated. The tiller in moving displaces the point K of the floating link G owing to the action of lever L, and by doing so, returns the spindle E to its mid-position. When this occurs the rudder stops and is held until H is again moved. At M will be noted a by-pass valve, so arranged that should the rudder be subjected to any severe shock from the sea, the stress will be relieved at a predetermined value and the rudder will give way. In doing this, however, it will move the spindle E and the pump will immediately return the rudder to its previous position. Leakage from any point is taken back to a small tank, and is returned to the system through a non-return valve on each cylinder. The whole system is thus self-contained and is charged with oil, preferably turbine oil, instead of water, and in this way perfect lubrication of all working parts is ensured, and temperature effects are eliminated.

The central feature of the above arrangement is, of course, the pump, and this has a high efficiency derived from simple mechanical contrivances, which can best be explained with the aid of the diagram in fig. 2. This represents diagrammatically a sectional view of the pump, in which A is the

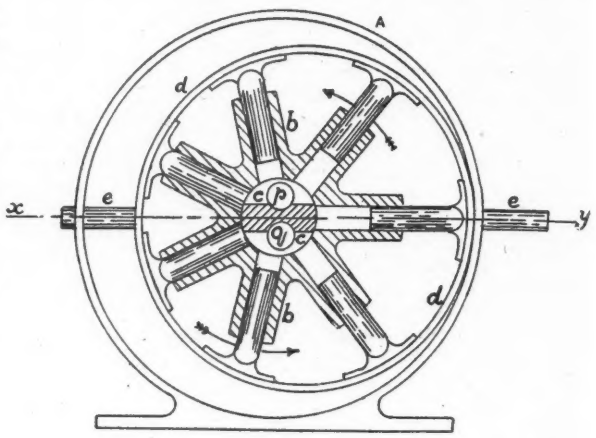


Fig. 2.—Sectional Elevation of Hele-Shaw Pump. Position full stroke; Suction through q, Discharge through p.

containing case forming the framework and support for the bearings. Within this is a cylinder body b b, revolving centrally with the containing case, and from which radiate a number of working cylinders attached to it. It revolves on a hardened steel circular shaft c c, and in this shaft are inlet and discharge ports occupying a little less than half the circumference. The incoming and outgoing oil approaches these ports by means of the passages p and q in the shaft. Sliding in the working cylinders are a number of plungers with their free ends pointing inwards towards the shaft, and a circular frame or guide ring d d acts as a guide for the outer end of the slippers which are attached to the plungers. This guide ring, which is capable of being placed eccentrically to the cylinder body, is supported from this body by the projecting guide e e, which is connected to the spindle shown in fig. 1. The cylinder body is supposed to be rotating in the direction shown by the arrows, and the slippers at the end of the plungers are maintained in contact with this guide. It will be seen that if the ports are suitably arranged in the central supports c c, oil will enter the

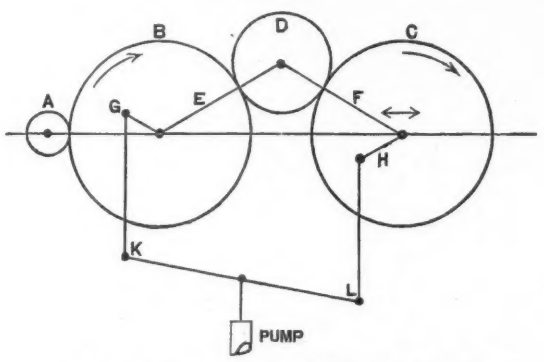


Fig. 3.—Diagram of Brown Hydraulic Gear.

cylinders, will then pass below the central line x y, and will be discharged again from the cylinders while they are travelling above it. In this case, the circular passage p becomes the outlet passage for the oil, while the passage q will be the supply passage. Now, supposing that the guide ring d d is moved horizontally throughout the stroke, and the projecting guide e e is in exactly the opposite position, and the direction of rotation of the cylinder body is unchanged; then by the same process of reasoning, the movement of the oil will be reversed in direction. In this

way, the liquid is reversed in direction of flow, and, therefore, the gear driven by it is reversed without any change being made in the rotation of the pump itself, and of the electric motor driving it. This reversal is effected without shock no matter how rapidly the mechanism may be moved, because the guide rings pass gradually from one extreme position to the other, through the central, in which no movement of the plungers takes place. Moreover, it will be seen that as the guide ring is moved a variation takes place in the volume of oil swept out by the pistons or in the rate of delivery to the pump. This is most important because, assuming that the motor operating the pump always exerts the same effort, and that this effort is converted into energy of moving oil by the pump, then evidently as the stroke or capacity of the pump is diminished as it approaches the central position the effect of leverage on the pump is increased, and hence with a diminished volume of oil moved, there is a corresponding increase of pressure upon it. From this it is evident that the pump is remarkably well adapted for steering-gear work, as it generally runs in its central position, and the slightest movement of the helm finds the pump in a position in which it is capable of exerting its maximum effort. Since it is in this position that the inertia of the rams and rudder has to be overcome, and since pressure in the pump rises instantaneously, the effect is that there is almost instantaneous response of the rudder to the slightest movement of the steering wheel. This gear, therefore, as fitted on the *Orama* and other vessels, has been found in practice to give most excellent results.

Turning now to another form of electro-hydraulic gear, which has been experimented upon by Messrs. Brown Bros., Ltd., of Edinburgh, and which promises to give good results, the source of power is again electric. The main idea is that the work which the electric motor has to do will be constant when the steering gear is being moved, as the amount of fluid per second discharged from the pumps operated by the motor multiplied by the pressure of the fluid will be practically constant. The pressure water or oil moves the rudder head by means of two ordinary rams of the usual type. The motor is a constantly running one, so that there is no starting and stopping in connection with it, and no switches or resistances are required, except the usual starting switch. If desired, the motor can have one, two, or more different speeds, the fastest being used when the ship is in narrow waters or docking, and the slowest being resorted to when the vessel is out at sea clear of all land and traffic, and only slow movements of the rudder are required to keep the ship on its course. As the whole of the parts will be seen to be ordinary mechanical details without requiring any special knowledge or tools to manufacture, there is nothing about the gear that is of an experimental or doubtful nature, and as a special oil is used the friction wear and tear is very little indeed.

The mechanism can be best understood by reference to fig. 3, a skeleton diagram showing the arrangement of the hydraulic transmission gear. The pump mechanism supplies fluid variable in amount or pressure to the necessary hydraulic ram, or rams, on the steering apparatus, and varies the pump delivery, while means are provided for maintaining a constant torque resistance in the driving shaft with a varying pressure in the transmission system. The arrangement consists essentially of two crankshafts arranged side by side, the first being fixed in position and operated by the motor, while the second is movable radially with respect to the first, and is driven by gearing from it.

The cranks engage with slotted cross heads, which have on them guide blocks sliding at their upper and lower ends in bosses placed in fixed brackets. These parts are in duplicate. Below them are blocks mounted so as to move with these cross heads, which engage slots in the outer ends of floating levers, which are pivoted at their centres upon the piston rods of two pumps. The fixed crankshaft is driven through a pinion A and gear from a shaft coupled to the motor. On the two crankshafts referred to above, one fixed, and the other movable, are similar pinions B and C which both gear with an intermediate pinion D, the shaft of which, connected by toggle links E, F, with the two crankshafts, must at all times remain in gear with the pinions on the crankshafts. The movable crankshaft is carried in blocks sliding in guides. Hence, if the intermediate pinion be moved downwards, the movable crankshaft will be forced laterally outwards in these guides by the toggle links, and the cranks will be altered in phase one to the other. If they move synchronously and in phase, so moving the floating lever K L bodily up and down, the full stroke of the pumps will be given, but when a certain point is reached in the downward movement of the intermediate pinion, the cranks will move in opposition, and the floating lever will be rocked on the pivot without moving the pump. The stroke of the pump will therefore vary between those limits in accordance with the position of the intermediate pinion.

This pinion may be adjusted in position by hand, but preferably it is automatically adjusted in the system, and with this latter arrangement there is maintained automatically a constant torque resistance in the shaft driven by the motor, in spite of the fact that the pressure in the transmission system varies. In order to effect this the spindle of the pinion is connected by links with a lever pivoted upon fixed brackets, and connected by links with the piston rod of a hydraulic cylinder, which is connected to the pump delivery, and is loaded by a spring whose tension can be adjusted. As the pressure in the pump delivery rises the piston, or ram, in this cylinder rises also, compressing the spring, and thus moving the link work so as to adjust the intermediate pinion described above, so as to shorten the effective stroke of the pumps. It will be seen that this system is very simple and easily applied to steering gear, and although it has not actually at the moment of writing been fitted to any ship, it is being subjected to a few months' running tests in the shops of Messrs. Brown Bros. to make sure of its operation. This experimental gear has fulfilled expectations in every way. When running light—that is to say, when no work is being done—only 7 amperes are taken from a 100-volt circuit. As soon, however, as fluid is being taken, the amperes rise to 30, remaining constant with a variation of 2 above and below until the pressure is reduced to 250 lb., at which the pumps have their full throw. The amperes then begin to come down until the water pressure is *nil* with the current at about 9 amperes. The range of pressures for which the gear is at present made is 1,500 lb. maximum and 250 minimum. The whole arrangement is practically automatic, and immediately the control valve is shut, the pressure rises to 250 lb. per square inch, when the pumps are in their neutral position, and there is, of course, no further increase. Immediately the control valve is opened so that the pressure is reduced, the pumps at once take up their work and the discharge is then the equivalent of the pressure in the main.

It would not be wise, in the present state of development of electric steering, to attempt to enlarge on the subject by reference to all the proposed types which have been suggested. The examples mentioned above, however, represent what may be described as advanced and careful thought upon this interesting subject, and indicate the lines along which electro-hydraulic steering is likely to be developed.

British-owned Vessel Driven by a Diesel Engine.—Last week the preliminary trial trip was carried out of the motor-ship *Eavestone*, owned by Messrs. Furness, Withy & Co., Ltd. The engine with which she is fitted has been supplied by Messrs. Richardsons, Westgarth & Co., of Middlesbrough, under joint licence from Messrs. Carels Frères, of Ghent, and the Diesel Engine Co., Ltd., of London. It will be remembered that lately the businesses of Messrs. Carels Frères and the Diesel Engine Co. were amalgamated in the formation of the Consolidated Diesel Engine Manufacturers, Ltd., and that extensive works for the construction of Diesel engines are being built by them at Ipswich. The engine has four separate vertical cylinders, each 20 in. by 36 in., and runs at 115 R.P.M., developing over 850 B.H.P. The engine consumes crude or residual oils, and works upon the two-cycle principle, by which a power stroke occurs at each revolution of the crankshaft, and the design embodies special features developed by Messrs. Carels Frères and the Diesel Engine Co. The *Eavestone* is the first large British-owned sea-going vessel to be equipped with a Diesel engine. As compared with a sister ship driven by steam engines, the extra space available for cargo on a 30 days' trip amounts to no less than 400 tons.

"WANTED, AN ASSISTANT——." THE STORY OF A FARCE.

By JUGGINS.

"Wanted, at once, an Assistant." Thus read the advertisement which was the beginning of this "Farce"; and thus, for that matter, commence so many of the farces connected with the filling of vacancies which occur in municipal electrical undertakings.

In the particular instance under consideration, the position was one of responsibility, and the salary attached to the post, although not excessively large, might be termed fair. As a consequence, aspirants to the position were numerous, in fact, well over 100, and in the "first act" we see the chief engineer, with his senior assistant, struggling through the applications, determined to select the most suitable man.

And this is no easy matter. Each applicant has some special qualification which fits him for the post, or, on the other hand, some are without some attribute, which, if possessed, might prove more of a hindrance than otherwise.

The chief and his assistant are, however, both alive to the fact that many men not suited in any way for the position, except in so far that their signatures would look well on the pay sheets, are using all manner of methods to try to cover their deficiencies and to show themselves up to the best advantage.

And the result is that most of the "swankers" (if the term may be allowed) are disqualified by the end of this preliminary act; but not necessarily all. In order, therefore, that the chief may be quite certain, he selects, say, a dozen candidates, and with the aid of his assistant, interviews them, plying them with all manner of questions, which cannot but reveal their weaknesses.

In this way the chief is able to form a definite opinion as to who is not necessarily the best man, but the man most suited for the postion which is vacant. Perhaps a second or even a third interview is necessary before the most suitable man can be finally decided on.

Now, it so happens that in municipal undertakings, the chief, before he can settle any single item, has to appeal to the Lighting Committee, and so in the next act, which undoubtedly is the making of the "farce," and yet which in itself is quite "dramatic," we see about half-a-dozen out of the original hundred served with writs to appear before the Committee.

The Committee, on examination, will be found to consist of anything from about six to 20 men, chiefly tradesmen and schoolmasters, and these, in turn, sometimes all at once, question each of the selected candidates.

But of what do these questions consist? Here is a typical one: "Are you married?" There is a rumour to the effect that a certain Committeeman once had the effrontery to ask a candidate his religious and political persuasions. In number the questions are usually few, and, perhaps, it is as well, since they relate to any topic but electricity.

Surely, then, it is reasonable to assume that under such circumstances the ultimate selection would be left to the chief engineer, on the results of his recent examinations of the candidates. But that is not so. It seems that vacancies are not filled by the possession of electrical knowledge and experience, but rather by the kindness of nature to some individuals in the matter of appearance, or by age, or even by "big boots."

Such was the result of the case here cited. Four candidates appeared before the Committee. The man on whom the chief engineer's choice fell was not given the post, on account of youth. Although he satisfied that electrical expert, the chief engineer, that he was just *the* man for the post, yet he was disqualified by a Committee of, roughly, 20 of all sorts, because he was too young.

It is, of course, consoling to that candidate to think that he is too young and not too old, but is it complimentary to the chief to think that his Committee have not sufficient faith in his abilities or good judgment to allow him to select the best man to fill a vacancy? And there were no "big boots" behind the scenes in this act. Some time ago the world was perhaps startled to hear that a man was "too old at forty." The youthful unsuccessful candidate wonders if the world would be startled to hear that one was too young at twenty-five. To limit the lease of useful life to fifteen years is rather unkind, to say the least, and as we refuse to believe a man to be too old at forty, so we fail to understand why a "man" of twenty-five should be too young.

Should this catch the eyes of Lighting Committees, the writer hopes they will take a lesson from it. As surely as it requires a butcher to dress meat respectably, so surely does it need an electrical engineer to select a capable man to fill a vacancy in the electrical profession. When will Committees understand that they have no right to interfere with their chief engineers in such matters as these?

When will they cease to select men with curly locks, or even grey hair, men with blue eyes or men using some other person's "big boots," and determine to have the most suitable man? that is, the man selected by the chief engineer. May it be soon.

COAL PURCHASE BY CALORIFIC CAPACITY.

By W. H. BOOTH.

There is another side to the much sounded system of buying coal on the basis of calorific capacity. Coal is, in its actual state, a very complex substance. As a fuel it ought to consist solely of carbon and hydrogen, and the hydrogen should not be combined with oxygen. There should be no nitrogen, no silica, no sulphur, or lime or magnesia. In actual coal there are all these impurities, and they are differently combined in every seam and in different areas of the same seam. And these different combinations cause the coals to behave very differently on the grate of a furnace. The impurities may produce merely a dry ash, which can be freely rattled through the openings of the grate, or they may produce a liquid glassy clinker which will melt and hang in strings into the ashpit, or the clinker may spread over the grate surface and effectually choke it. It is these differences that produce coals which possess various characteristics, such as self stoking, quick burning, long flaming, short flaming, dusty, and so on. That coal which has the highest calorific capacity per unit of weight may not be the coal which will put most heat units into the water in the boiler per unit of coal used, or per price, or per hour, all which factors may count in the choice of a coal. For a coal giving a bad clinker in a hot fire cannot, perhaps, be burned in a boiler plant of limited capacity. Then, again, is it desirable by means of certain too arbitrary specifications so to narrow down the choice of coal as to result in permanent waste of fuel, in the deliberate leaving of coal in the mine? Some of the coal specifications one reads are the effusion of the type of man who demands everything of the impossible best variety, and wants to reject every knot in a piece of timber as though it were of the order of a blister in a furnace plate instead of being a natural product. Some coal specifications would demand a coal with an impossibly low percentage of ash. Many coals possess a considerable percentage of ash that does not enter as slate or bass, as a result of a careless hewer. The ash is disseminated throughout the mass of coal and cannot be washed out. Now if all such coals were to be rejected by everyone the price of coal generally would be enormously enhanced and the rejected coal would be left in the pit. As a national asset, every pound of coal left in the pit is represented by a pound of some better coal taken out, and the coal reserves of the country, indeed of the world, are by so much reduced. It is our habit to regard coal as a national asset of great importance. It is so regarded by most of Europe and all North America and Australia, and all the grimy, dirty work which coal enables man to undertake, has gripped men's minds so firmly as a necessity of national prosperity that very few of us regard the scheme of modern industry as a mere passing phase in human life on earth, a phase that in its present hideous development must inevitably cease in a few hundred years at the outside.

True, having set out on the path we have to follow it out to its end, and we cannot say, "Here are we in error! let us back to the conditions of the regretted past." The worst thought we ever have thrust on us is that our coal may give out before that of other nations, and we shall become by comparison even as Holland is to-day, a comparatively non-industrial country with none of our people toiling on hot furnaces or in the dusty dangerous mine. But as we at present desire to push as far off as possible this desirable condition, we ought to regard it as a duty to take care of our coal by refusing to enact such systems of purchase of it as will induce the mining community to exploit it wastefully. A man's life is so short and a mine's life so comparatively long, that the man will shorten the life of the mine if by doing so he can profit a shilling in place of 11d. He himself looks for, say, 20 years at 1s. per unit of output rather than 40 years of the more moderate 11d. rate. All the high grade fanciful ideas of purchasing the best and rejecting what nature has supplied in greater quantity would, if they became universal, bring about the rapid depletion of the coal reserves and a great enhancement of price. Coal, not having been foreseen, became, by oversight, private property, so that the State cannot step in and demand that 97 per cent. or other ratio must be brought to the surface. Much the larger portion of the coal once worked in Staffordshire was left below in waste, and pillars, and even if recoverable, is lost for want of proper records of its locality.

Probably such influence as is wielded by the State is expended rather in the direction of causing coal to be left underground than of conserving every pound of it. It rests, therefore, with the good sense of the community not to formulate such impracticable demands as shall conduce to wasteful exploitation.

There is a tendency among public bodies to set up such impossible standards. Municipalities which put forward specifications for all manner of articles, all to be of the very highest quality, are among the chief offenders, and they pay very much more for goods than their intrinsic value.

The exacting specification for coal, or any other product, invariably means that the ratepayer or the shareholder has bigger rates to pay or less dividends to receive, because, for the very best of coal, there is not enough to fill the demand of the "crank" specification, and inferior stuff is smuggled through at the "crank" price. And, in any case, it is bad national policy to set up, as it were, an aristocracy among the coal heaps, so that the best coals are sold at a price not warranted by their calorific capacity or practical utility, after all.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Railway Cab-Signalling.

The first paragraph of Mr. Dupré's letter, in your current issue, greatly surprised me. My previous letter, far from corroborating, plainly contradicted his contention.

In this connection, it will be well to remember that the question is not whether rubbing or rolling is better for electrical contact. The question at issue is formulated only when we add the restriction of high train speeds together with dirt, rust or ice.

Considering the fact that my wheel pressure on a ramp was certainly greater than 150 lb., and that Mr. Dupré says that my apparatus was "too sensitive under perfect conditions of contact," it is pertinent to ask the meaning of his language (in his previous letter) to the effect that "sliding contact can be kept so light," &c. I consider 150 lb. rather heavy here. I found this weight amply sufficient for rolling contact under the extremely imperfect conditions of contact under which all such members must operate.

My article, which precipitated this discussion, plainly shows that what Mr. Dupré calls an "imperfect contact" is not my "sole factor of safety." I show that if failure of this contact produces an error of indication at all, it can produce only the safe error. Since he brands as "imperfect" the rolling contact, which never failed, why does he not also designate as "imperfect" the rubbing contact, which, under the same practical conditions, repeatedly made safe errors?

It is exceedingly easy to prove that the Brown-Mackenzie system is not "absolutely reliable." If Mr. Dupré will supply me with a copy of the pamphlet to which he refers, I shall be glad to go into detail in this matter. For the present a few facts of a somewhat general character will suffice. From the *Railway Engineer* of last June it is obvious that the Brown-Mackenzie cab signal will indicate "clear" when the correct indication would be "stop" in event "the track wires should for any reason become cross-connected, or if contact should accidentally be made between the angle irons composing a group of ramps." In this respect the Brown-Mackenzie system is certainly far less reliable than the system illustrated by fig. 3 of my article. It is quite true that the Brown-Mackenzie system provides a magnet which in effect "breaks the main circuit," "de-energises all the coils, and exhibits a danger signal;" but this magnet cannot produce this vitally important result if the magnet coil is short-circuited or open-circuited.

The Brown-Mackenzie system requires as many as five ramps at a given point along the track, while the cab system approved by me requires no more than two, and the grounding of these two ramps will not produce a false "clear" signal. The breaking of the ramp-engaging members in the Brown-Mackenzie system (by ramp action or by a foreign body on the track) would result in failure to give the "danger" indication at the next ramp ahead, even if the track immediately in advance is obstructed.

William H. Dammond.

West Bridgford, Notts.,
August 2nd, 1912.

The Standing of the Engineer.

At the time—about six weeks ago—that an article from Mr. Goody appeared in your paper, I was tempted to add my comment, but refrained. However, after reading last week's REVIEW and noting the advertisement *re* the "Constructional Engineer" required by the Birmingham Corporation, I should like to make a few remarks. As can be seen from the advertisement, the man required must be an engineer of first-rate ability, able to prepare specifications, have a knowledge of architectural requirements, able to superintend the erection of practically all types of steam and electric plant, conduct trials, &c., and also take charge of a drawing office. The salary offered is £400-£500 per annum, which is not over much in my humble opinion. However, my main object in writing this is to remark that, side by side with the qualifications of the engineer required, it would be interesting to know the corresponding responsibilities of the "Secretary" that a certain Corporation Electricity Department appointed at a commencing salary of £600 per annum, about 18 months ago. Electricity concerns are made, and exist, by reason of their engineering staffs, and I consider these self-same staffs should not in any way, either financially or socially, be subordinate to the clerical staff. There is too much of the "Manager and Secretary" business already.

Interested.

Indirect Lighting.

It is rather amusing to read in recent issues of the ELECTRICAL REVIEW of the value of indirect and semi-indirect lighting. It would appear that some of your contributors have awakened from a Rip van Winkle sleep, and with their eyes dazzled by the brilliancy of metal-filament lamps, have rushed into print with their ideas without considering that for some years now such lighting has been recommended and practised by the General Electric Co., Ltd., who have devoted considerable attention to this charmingly efficient system of lighting.

For some years now the G.E. Co. have produced and supplied in increasing quantities fittings of this nature for use in private, public, and institutional buildings. In direct lighting the bulk of light is wasted by absorption in the

decorative scheme and by shadows cast from objects. Where the direct light falls upon high reflecting surfaces, such as books, papers, white tablecloths, &c., the eye cannot easily accommodate itself without undue strain, due to constant contraction in the endeavour to adjust itself, as it changes its view from a light absorbing material to one of high reflective brilliancy.

The natural working light of daylight is a diffused light; hence, if we approximate to daylight conditions in our artificial lighting by illuminating our largest reflecting surface, viz., the white ceiling, we get the light rays reflected over the whole of the working plane, eliminate shadows and get as much light as the eye requires to work with easily and comfortably. A certain amount of filtration of light takes place by reflection from the ceiling, rendering the value of the light of great importance in any decorative scheme, and allowing pictures to retain their true colour value by artificial light.

Of the two methods, under ordinary conditions, we strongly recommend totally reflected light as fulfilling every requirement. So thorough is the diffusion of light that it is possible to hold a sheet of white paper a few inches below the solid reflector without any shadow falling on the paper.

Under certain conditions (other than personal preference) it is necessary to use semi-indirect lighting or to have specially designed fittings which embody a suspended reflector to take the place of the ceiling, where the ceiling is too lofty or too indifferent a reflector. For hospitals and other institutional buildings of a like nature the Willard fitting adequately fulfils its purpose. There is the minimum of tarnishable metal, the reflector being made in vitreous enamel, with a complete clear glass dust cover, and a diffusing bowl of opal glass to soften the direct rays.

Fred. T. Cash.

Sidcup, *July 24th*, 1912.

THE BRAY EXPLOSION.

We are now enabled to publish the reports of the various engineers who inspected the plant at the Bray electricity works, as well as that of the deputy electrical engineer, Mr. D. E. McDonnell, who has now been appointed to carry out the extension scheme, and to act as resident engineer for the present.

Dr. Lilly, of Trinity College, and Mr. William Ross, M.I.M.E., of the firm of Ross & Walpole, engineers, Dublin, were engaged by the Council to investigate the matter, and reported as under:—

"We find that the explosion in the Diesel engine was due to the use of pure oxygen instead of air. The builders of the engine were cognisant of the fact that oxygen was being used for starting the engine, as stated in your engineer's letter to them of February 15th, 1912. It appears that the use of oxygen for such a purpose in engines of this kind is dangerous. This explosion resulted from its use.

"A careful examination of the Diesel engine and of the wreckage of the air-injection cylinder, &c., shows that the explosion was not only one of great violence, but also of extreme rapidity, from which we infer that something abnormal must have taken place. The explosion occurred during the starting of the engine, after a period of idleness for a few days. We have ascertained the following facts:—

"1. Before starting the engine the blast cylinder and one starting receiver were partially charged with oxygen under pressure, ordered from, and supplied by, Messrs. Mason, of Dame Street, Dublin.

"2. On starting, the engine cylinder was connected with the starting receiver in the usual manner. The effect of this was to fill the engine cylinder and connections with air highly charged with oxygen

"3. On changing over the engine to run on fuel supply and blast, the explosion, or explosions, took place.

"4. The condition of the engine and wreckage points to the conclusion that the explosion was caused by the presence of the oxygen with fuel, somewhat in the following manner:—

"Near the completion of the compression stroke of the engine, the compressed air being charged with oxygen and fuel, exploded in the engine cylinder, with a rise of pressure far above that obtained under the usual working conditions with air. This pressure exceeded that in the air injection cylinder and pipe connected to the fuel valve; the flame from the engine cylinder ignited the mixture, and caused the explosion to be transmitted through the connecting pipe to the air-injection cylinder.

"5. The condition of the wreckage of the air-injection cylinder indicated that the explosion was instantaneous, and gave rise to enormous pressure. This was probably due to a rich mixture of nearly pure oxygen and oil vapour in the cylinder."

Mr. E. G. Hiller, chief engineer of the National Boiler Insurance Co., Ltd., reported as follows:—

"The explosion consisted of the development of explosive energy in the blast receiver, which destroyed the blast receiver, and caused other damage. Apparently this explosive development occurred owing to the combination of the oxygen in the blast receiver, with oil in the receiver or its passages.

"The fragments of the receiver and its connections were carefully examined, and I have to say that there are no indications of any defect of construction or condition which would account for the explosion.

"We have no record of any preceding accident of a like nature in connection with engines of this type. The accident must be looked upon as unique, and we have no evidence whatever on which blame could be fairly attributed to any person."

Mr. Donald E. McDonnell, deputy electrical engineer, reported as follows:—

"On Sunday, the 7th inst., the starting air of the Diesel was lost, and, following the instructions of the engine builders, Mr. Sowter sent to Dublin for a 40-ft. cylinder of oxygen. On the 10th we charged the blast receiver from this cylinder, raising the pressure from 350 lb. to 700 lb., and also passed a little into one of the starting receivers; the pressure in the latter was about 350 lb.

"I started up the engine in the usual manner, and, going on to platform, put the starting lever into the running position. The engine did not appear to be running properly, but before I could discover what was wrong the fuel valve on the cylinder cover of the engine exploded; the flame from this burst along the blast pipe, reaching the blast receiver, which then also exploded.

"I attach copy of the paragraph from the makers' instruction-book which relates to the use of oxygen. From this you will see that we had every reason to believe that there was nothing hazardous nor very unusual in using this gas:—'If by any mishap the air is lost, and no compressor is available, or if the engine cannot be run by external means so as to charge the receivers with its own compressor, then these may be charged with carbonic acid gas or oxygen from cylinders containing these compressed gases, as used for many purposes.'

"In the ordinary course of events there would be no explosive mixture in these receivers, and I consider that there is no danger of a repetition of such an explosion. Personally, I will have quite as much confidence in the Diesel engine as I had before the accident."

In reply to inquiries that we have made, Mr. McDonnell has kindly furnished the following additional information:—

"The broken pieces of the receiver were perfectly free from oil. It is assumed that the explosion may have removed any which may have been deposited on the inside walls. The only oil which could get into receiver would be carried over in the form of vapour from the air-compressor, and would be from the lubricating oil. It appears that this does occur sometimes.

"The connection from the blast receiver to the fuel valve of the engine consists of about 14 ft. of $\frac{3}{8}$ in. bare copper tube. Crude Texas oil fuel has been used since the engine was installed, about 2½ years ago. No other quality has been used except to start the engine, should she have been lying off for any time or have been dismantled, when ordinary paraffin oil is used. It is difficult to see how oil could creep back to the blast receiver, as there is a practically continuous stream of air from this receiver to the fuel valve of the engine when the engine is running.

"The blast pipe always seemed clean and dry whenever it was examined."

Our comments on the circumstances will be found in our leading columns.

PARLIAMENTARY.

Sheffield Corporation Bill.

On Thursday and Friday, July 25th and 26th, a Select Committee of the House of Lords, presided over by the Duke of Wellington, considered the Bill promoted by the Sheffield Corporation. Mr. Honoratus Lloyd, K.C., Mr. Clode and Mr. Jeeves appeared for the promoters, while Mr. Ernest Page, K.C., and Mr. M. N. Drucquer represented a body of electrical engineers and contractors, who were ratepayers, in opposition to the Bill.

Mr. Lloyd, in opening, explained that the contentious part of the Bill was Clause 90, which provided that the Corporation might sell, let for hire and fix, repair and remove, but not manufacture, lamps, motors, electric fuses, switches, lampholders, motors and other electrical fittings, for lighting, motive power or other purposes. The clause also contained power for the Corporation to wire private property. Proceeding to explain the special circumstances which existed at Sheffield, counsel said that the electricity supply of the city was first carried on by a limited company under a provisional order. That company carried on the business both of manufacturing fittings and their supply to consumers and also the wiring of consumers' premises. In 1897, the Corporation gave the company notice requiring them to sell them their undertaking, and in the following year the Corporation purchased the whole of the undertaking by agreement. In 1903 the Corporation was presenting a Bill in Parliament which contained a somewhat similar clause to the one in the present Bill. At that time a number of gentlemen interested in the electrical fitting trade objected to the Corporation carrying on this particular class of business in competition with private traders. A good deal of discussion took place, and eventually the

Corporation told the objectors that they were convinced they had the power to do these things, having bought and taken over the rights of the limited company. They, however, struck the powers out of their Bill in 1903, at the same time making it quite clear to the private traders that it was not with the view of depriving themselves of any power to go on with the wiring and fitting business which they had carried on, and which they intended to continue to carry on, in the future. Three years later a Mr. Davidson, who was interested in the trade of electrical fittings, brought an action against the Corporation, and in the result Mr. Justice Eve decided that they were not entitled to carry on that particular business. The Corporation announced their intention of appealing, and under those circumstances the judge said he would not grant an injunction against them, but he would make a declaration that they were not entitled to carry on the business, with liberty to apply for an injunction if it became necessary. At that time counsel for the Corporation announced that they were proposing to apply to Parliament for a Bill to make it quite clear that they had the powers under the special circumstances of the Act of 1898, and it was under those circumstances that the present Bill came before their Lordships.

Evidence on behalf of the promoters was given by Alderman Robert Styring, a member of the Sheffield Electric Lighting Committee, who said his view was that the Corporation ought to have as much power in the way of providing electric light fittings as the gas companies.

Cross-examined by Mr. Page, witness said that under the Act of 1898 he claimed that they were acting within their powers in doing such work, but of course they were bound by the decision of Mr. Justice Eve so long as it was not altered by the Court of Appeal.

Mr. Albert Davidson, examined by Mr. Drucquer, said he appeared to oppose the Bill. He was a ratepayer of Sheffield, and used to carry on business as an electrical contractor. He gave up the business because he found the Corporation's competition was so keen. He thought that by their own showing the Corporation had proved that their competition was unfair. For one thing, they appointed canvassers and were first in the field. If a trader had an inquiry for work he had to give notice to the Corporation, and by that means they tried, if possible, to oust the trader. Not only were they able to get first information, but on the point of cost they possessed an advantage over the private trader. An ordinary trader had to take all things that came against the business, and had to make an adequate charge against his gross profits, whereas if the Corporation could obtain the use of premises for nothing, if they could neglect depreciation of stock and obsolescence of any stock, they did not show a proper amount of standing charges against their prime costs. If the evidence which was given that their gross profit showed 15 per cent. profit on their turnover was correct, then he submitted, as a commercial man, that when those gross profits had been subjected to the ordinary charges that appertained to an ordinary commercial business, they would entirely disappear.

After evidence had been given by Mr. A. J. Ward, a director of Thomas Ward & Co., secretary to the Sheffield branch of the Electrical Contractors' Association, and Mr. R. Tweedy Smith, the honorary solicitor to the Association, the Chairman said the Committee had decided that the model clause should be inserted, and Clause 90 struck out. By the model clause the Corporation are not at liberty to execute the wiring of private property except between the main of the Corporation and the consumer's meter, nor can they sell any electrical fittings except through a contractor.

The Bill will be read a third time in the House of Lords in the autumn session.

Clyde Valley Electrical Power Order Confirmation Bill.—In the House of Commons, on 5th inst., this Bill was read a third time.

Wolverhampton Electricity Supply.—The Corporation has made an arrangement with the Midland Electric Corporation for Power Distribution, Ltd., whereby the latter is to forgo its rights for the supply of electrical energy in the parish of Bushbury on consideration of the sum of £500. To this end the Corporation is to apply for a prov. order annulling the present one in favour of the company, which has 30 years to run. By agreement with the company the Corporation has been for some time supplying the Electric Construction Co., Ltd., whose works are situate within the area of Bushbury, with power; and as the Construction Co. proposes to increase the quantity of electricity supplied to its works, it follows that if the negotiations at present proceeding are brought to a successful issue, the revenue obtainable for the works will be appreciably increased.

One of the old storage batteries at Commercial Road is to be removed to the Tettenhall Road sub-station, and refixed there at an estimated cost (after sale of old surplus material) of £800.

The Australian Commonwealth.—The new building of the Australian Commonwealth in the Strand is to possess its own water supply. An artesian well and electrically-driven pump are to be constructed and supplied to the specification of Mr. W. H. Booth, of 5, Broad Street Place, E.C. The borehole will extend about 200 ft. into the chalk which underlies the Tertiary deposits of the London basin. As is well known, the chalk water from under these deposits is usually a fairly soft water, differing considerably from chalk water obtained from chalk not so covered.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Fittings.

Although metal-filament lamps are not nearly so sensitive to vibration as was the case a short time ago, even now the life of a lamp can be considerably lengthened by the use of an anti-vibration spring, and the Electrical Engineering and Equipment Co., Ltd., of 109-111, New Oxford Street, W.C., have introduced new types of suspension fittings in which the springs are enclosed in porcelain caps, which serve to insulate the metal-filament lamp fitting, as well as to protect the spring. These fittings contain springs adjusted for weights from 6 oz. to 15 lb., and are generally adopted for small water-tight fittings. For fittings over 15 lb. in weight, a larger type is supplied, consisting of a cast-iron case with an insulated interior completely enclosing the spring, which is normally in compression. These are also very suitable for arc lamp suspension on tramway standards, in great measure preventing the overfeeding of the lamps.

We illustrate herewith some new fittings supplied by the company, which are designed with an elaborate arrangement of ventilation. Inside the glass globe a steady circulation of air is produced, which keeps the lamp cool and ensures its running under

Fig. 1.—E.E.E. Cast-Iron Fitting.

more or less normal conditions. A small hole is made in the base of the globe, and the top of the fitting is provided with a C.I. mushroom cap which is held from the main fitting by three small bosses, giving a large air passage. The main body of the fitting is

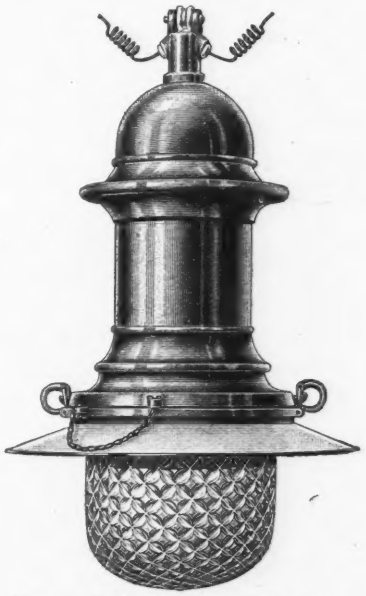
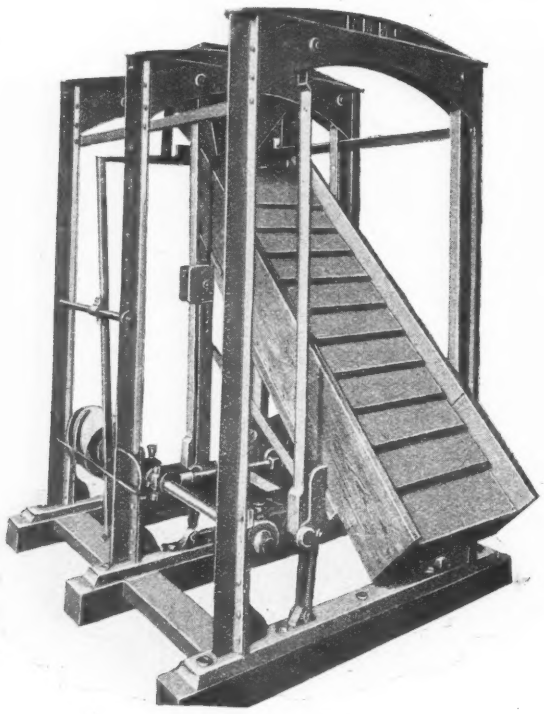


Fig. 2.—E.E.E. Spun Steel Fitting.

of enamelled C.I. and can be supplied with reflectors of spun sheet iron, vitreous enamelled. The fittings are made up in sizes for lamps from 100 c.p. up to multiple lamp fittings with a total c.p. of 2,400. Fig. 1 shows a fitting suitable for one 600-c.p. lamp, or as many as 7 lamps of 50 c.p. each. Several other sizes of similar design are made. Fig. 2 is a watertight fitting made up entirely of spun steel with vitreous enamel, and designed with the idea of replacing arc lamps for shop lighting; a very pleasing effect is given with the specially moulded globes illustrated, the light being diffused evenly in all directions.

Magnetic Separator.

In our issue of July 5th, we described the new type of machine shown at the Non-Ferrous Metals Exhibition, by the Rapid Magnetting Machine Co., Ltd., for removing small percentages of iron completely. The accompanying illustration shows the



Rapid Magnetting.

appearance of the machine: the shoot practically consists of a staircase with brass treads and magnetised iron risers, as previously explained, and it is practically impossible for iron particles to run the gauntlet successfully.

BUSINESS NOTES.

Book Notices.—*Universal Directory of Railway Officials*, 1912. London: The Directory Publishing Co., Ltd. 10s.—This useful directory has now reached its eighteenth edition. It is as usual compiled from official sources under the direction of Mr. S. R. Blundstone, and by its system of arrangement one is easily able to find out anything of importance, in the statistical or personal way, regarding home and colonial and foreign railways.

Consular Notes.—Peru.—The British Consul at Iquitos reports that the Telefunken system of wireless telegraph is being adhered to by the Telegraph Department, and it is hoped to establish direct communication with Lima, across the chain of the Andes, 6,000 m. high. A new tower has been erected at Iquitos, and another near Lima, on the Cerro San Cristobal. Experiments carried on between a steamer at Valparaiso and another at Bahia Blanca, which are 1,250 km. apart, with the Cordillera between, at a height of 6,000 m., gave an excellent communication with a power of 1·5 kw. The next important link to join up will be with Manaos.

Switzerland.—The British Consul at Zurich reports that although Switzerland has no coal, she has, on the other hand, enormous hydraulic power, and the application of this great force has made considerable headway during the last 15 years, numerous factories being now driven by electric power. The hydraulic force capable of utilisation in Switzerland is estimated at 722,600 h.p. The electrification of the Federal Railways is only a question of time, and this will, in some measure, free Switzerland from the tribute she now has to pay to foreign countries for fuel. The electrical industry in Switzerland has undoubtedly a great future before it. The cost of the application of electricity in Switzerland is less than in other European countries, and in almost all towns and in a large number of villages it is used not only for lighting purposes, but also for motive power. This is one of the reasons why the Swiss industries are able to combat foreign competition. The Commission appointed to inquire into the electrification of the Federal Railways has calculated that the horse-power for every 24 hours necessary for electric traction on a normal gauge would be 100,000 in winter and 125,000 in summer. As the horse-power in the country, which is still unused at the present moment amounts to over 500,000, only one quarter of the hydraulic power in Switzerland would be necessary for the electrification of the entire network of the Federal Railways. The Swiss engineering industry suffered somewhat during the year 1911 by reason of foreign competition and foreign protective tariffs, although towards the end of the year the exports showed a slight improvement. The electrical home trade was also considerably affected by certain cautional regulations for fiscal purposes, although this reduction was somewhat compensated for by an increase in exports. It is confidently hoped that the anticipated electrification of the Swiss railways will bring about an improvement in this industry. A Swiss engineering journal in referring to the increasing severity of competition with which Swiss engineers have to contend not only in foreign markets but also in the supply of machinery for engineering enterprises within the country, states that exports of machinery from Switzerland to neighbouring countries are becoming more and more difficult in consequence of increasing tariff rates, whilst foreign Governments and municipal bodies restrict deliveries of the necessary supplies for State undertakings, military, naval and railway departments to their home factories.

Elsewhere in his report the Consul says: "The returns for 1911 are not yet known, but the number of British commercial travellers visiting this country has never in any one year exceeded 70. There are many firms who send their representatives to Germany, France, Austria-Hungary and Italy, and a visit to the principal centres of trade in Switzerland (Zurich, Berne, Basle and Geneva) might well be included at little extra expenditure of time and money. If, however, it is not convenient to send travellers, the appointment of Swiss agents, who are generally able to correspond in English, would be the most likely way of securing a better share of trade. I have in previous reports pointed out the necessity of catalogues being printed in the French or German language, also of weights and measures being given in the metric system and prices quoted in francs. One of the principal Swiss trade organs, in an article on my last report, it is stated that British exporters would undoubtedly gain a considerable advantage by adopting such a reform, which has long been earnestly desired by the leading Swiss firms interested in the import of British goods. A further aid to the development of British trade in Switzerland would be advertising in trade journals. There are numerous special trade journals published both in French and German Switzerland which are indispensable to Swiss traders. German and French manufacturers have adopted a regular and extensive system of thus bringing their special goods before the Swiss public."

Cuba.—The British Vice-Consul at Havana reports that a concession was granted at the beginning of the year to the Palmira and Cruces Electric Railway and Power Co. to utilise the waters of the Habranilla River for the supply of its power plant. All machinery, engines, tools and rolling stock were to be admitted free of duty. The company will build a standard gauge railway 225 miles long, in Santa Clara province, opening up sugar and tobacco lands. It will probably be five years in building. Further, a concrete dam, 1,000 ft. long and 75 ft. high, will be built for the storage of water. The capital of the company, which will claim no subsidies, is £4,000,000. Plant to develop 30,000 h.p. will be installed and light and power supplied to the towns and sugar mills on its route.

Bolivia.—The British Vice-Consul at La Paz reports that the electric lighting and tramway system of the city of Cochabamba has drawn German capital to the extent of about half of the total investments, but the total amount of German capital in the Republic is probably under £1,000,000, as compared with £6,000,000 British capital, invested chiefly in mines and railways. The result is that the United Kingdom holds an overwhelming proportion of the total trade of the country. The British Vice-Consul reports that the most important work in his district to be noted is that of the Sucre water supply, now approaching conclusion. This work is on the gravitation system, starting from Cajamarca, a watershed distant about 15 miles from Sucre, where the intakes are situated. The water is thence conducted through 10,000 metres of aqueduct, 1,560 metres of tunnel, and 17,700 metres of 25 and 17 centimetre steel pipes. The supply averages approximately 100 gallons of water per minute, and is held in a high-level reservoir of 357,500 gallons capacity. Here, where the vertical fall from the storage reservoir is 350 metres, a power station is being equipped with dynamos capable of developing 208 h.p. for a municipal supply of light and power. The whole work was to be concluded in May of this year, and about £176,000 had already been expended, exclusive of the electrical plant.

The British Vice-Consul at Potosi reports that the hydro-electric light and power supply installation was completed last year by private enterprise (Vladislavia & Co.) at a cost of £64,000. The water from numerous water-courses around Potosi, the waste and surplus water from the mining establishments and the town itself, is all accumulated in a large reservoir of 300,000 cb. m. capacity, from which, through 750 m. of 24-in. piping with a vertical drop of 120 m., it is supplied to the turbine motors. The power station is distant about 2¾ miles from the city, and is fitted with dynamos capable of developing 450 h.p. Only about 160 h.p., *i.e.*, 80 for street lighting, 70 for house lighting and 10 for industrial purposes, is at present used, however, while the distributing plant is being gradually extended. The demand for private lighting and for industrial purposes is larger than can be supplied at once. In time electrical power will be available in the mines for driving air-fans, blasts, drills, for traction and for hoisting plant.

The British Vice-Consul at Oruro reports that work on the electric tramway system of Cochabamba is being actively proceeded with. The passenger traffic on the completed portion is larger than was expected, and is leaving a good profit. During the year 1911, several important British firms have established agencies in Oruro.

These firms previously did a certain amount of business in the district, but the establishment of agencies is a new departure for British firms there, and may be looked upon as an appreciation of the increasing importance of the market of this mining centre, as well as an attempt to acquire a larger share of the trade. Of this business an important part consists in supplying the mines with mining material and stores, in exporting the mine product, and in advancing money in suitable cases for the better working of the mines.

Bankruptcy Proceedings. — Henry Hallifield Oxley (otherwise known as Oliver Huxley) consulting engineer, 22, Uxbridge Road, Hanwell, Middlesex. The following are creditors herein :—

Anderson, John	£260	Oxley, Olive V.	£110
Brit. and For. Invest. Corp. ..	152	Peek, T. W.	60
General Electric Co.	25	Stone, Geo...	54
Harrop, John, Ltd.	35	Trentham, N. H.	46
Jarvis, Thos. H.	156	Waring & Gillow	91
Oxley, H...	402	Sells Agency	14

John Wm. Garsden, electrical engineer, carrying on business at 24, Preston New Road, Blackburn.—At Blackburn Bankruptcy Court, on August 2nd, this first examination took place. The liabilities were £5,038, and the deficiency amounted to £4,111. Debtor attributed his failue to "being jointly and severally liable for a sum of £1,100 in connection with a previous partnership for which he did not consider himself liable." The circumstances were stated in our issue of July 26th. Questioned by the Official Receiver, debtor said it was solely in consequence of this judgment against him regarding the partnership liability that he found it necessary to file his petition. His present business was paying well, and he had been engaged in some good contracts. At the close of the case the Registrar told debtor he had been well advised to come to that Court, and he must say that it was misfortune which had brought him there. He hoped he would get out of it as well as possible. His advice to him was to give all the information he could, and he would then find that for an honest trader the Bankruptcy Court was not a bad Court at all to deal with.

Private Arrangement.—H. G. Norton & Co., Ltd., automobile, cycle and electrical engineers, Cheltenham and Gloucester.—With reference to the above, particulars of which have already appeared, the following are creditors :—

Ayres, F. H., Ltd.	£24	Henley's Teleg. Works, Ltd. ..	£33
Bransom, Kent & Co.	46	Kempshall Tyre Co.	101
Brown Bros., Ltd.	45	Michelin Tyre Co.	120
Continental Tyre & Rubber Co.	525	Minerva, Ltd.	22
Carless, Capel & Leonard ..	107	Marshall Tyre Jacket Synd. ..	50
Cooper Steward Eng. Co. ..	50	Moeller & Co.	23
Crompton & Co.	115	Price's Patent Candle Co. ..	31
Crowden, Garrod, Ltd.	59	Palmer Tyre Co.	200
Cresswell Bros.	16	Phosphor Bronze Co.	27
De Nevers Rubber & Tyre Co.	44	Pneumatic, Ltd.	29
Elecl. Power Storage Co. ..	44	Parsons, T., & Sons	41
Falk, Stadelmann & Co. ..	420	Smith, S., & Son	22
Faraday & Son	22	Simmons & Co.	26
Goodwin, A. A.	31	Vandervell, C. A., & Co. ..	34
Harlford, W., & Son	26	Weil Bros., Ltd.	26
Hyde, Archer & Co.	20	Wilson, R. W., & Son	35

and a number of others for smaller sums.

Flat-Iron Endurance.—The British Prometheus Co., Ltd., have sent us a copy of a letter from a client, who says that he has had one of their 5 or 6-lb. electric irons in constant use for over 10 years without a single failure beyond a break in the flexible cord. It was first used on a 200-volt circuit, and then removed to a 230-volt one. It was not thought worth while rewinding the elements as the iron had already had such a good life, but it is found to work even better on the higher voltage. It has been so employed for the last four years, and has not yet given out.

Catalogues and Lists.—Messrs. Mason & Brown, Volta Works, Rutland Street, Leicester.—36-pp. catalogue (Section "M") containing illustrated particulars with prices of a variety of motor-car and cycle accessories, switches, coils, plugs, magnetos, instruments, indicators, and so forth.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, London, N.—32-pp. catalogue (third edition), in which is given a full description of their oil engines (Cross patents), which they are building in sizes from 5 H.P. upwards. Sectional views of complete engines and parts thereof are given, and the half-tone views include self-contained electric sets.

Messrs. Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—New publication, containing a very full descriptive account, accompanied with numerous excellent half-tone views, of the "Sirocco" induced draught fans for electric power station, colliery, and other service.

Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester. —Pamphlet describing and showing their patent Cracore solid bitumen cable for mining and other service.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—Illustrated price list (Section "L") of electric lighting accessories such as ceiling roses, lampholders, various switches, lamps, conduit fittings, and so forth.

The British Thomson-Houston Co., Ltd., Rugby.—Two new price lists; No. 368 (16 pages) gives an illustrated description showing parts of small motors, also complete motors applied to different classes of work, such as the driving of vacuum cleaners, hat cleaners, ice-making machines, buffing and grinding attachments, air pumps and cinematograph machines. No. 369 (four pages) deals with B.T.-H. C.C. motors, type DA. Prices are tabulated in detail, and dimensional and weight information is given in both lists.

Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, Dalston, London, N.E., as part of their efforts to popularise their tantalum lamps in China, have prepared a very useful show-card printed in 11 colours. It bears a pictorial representation of rising China eager to embrace the lamp because of its light-giving qualities, and will no doubt prove itself to be very suitable for the market, and capable of bringing demands upon the Siemens China Electrical Engineering Co., of Shanghai, Tientsin, Peking, Hankow, and Hong Kong, wherever the card may be exhibited or distributed.

Dissolutions and Liquidations.—Black Sea Telegraph Co., Ltd.—A meeting of creditors is to be held at Electra House, E.C., on August 12th. They must send particulars of their debts, &c., to Bircham & Co., 50, Old Broad Street, E.C., the solicitors for the liquidators, by September 20th.

Traction Supplies Co., Ltd.—This company on July 30th resolved to wind up voluntarily, with Mr. T. Metcalf, 48, Frederick Street, Sunderland, as liquidator. A meeting of creditors will be held on August 15th at the address mentioned.

Herbert Moore & Co., electrical engineers and range fitters, 3, Stratford Road, Kensington, London.—Messrs. G. and R. J. Moore have dissolved partnership. The former attends to debts, &c., and will continue the business.

LIGHTING and POWER NOTES.

Acton.—At a recent special meeting of the U.D.C., outstanding matters relating to the transfer of the electricity undertaking from the Council to the Metropolitan Electricity Supply Co. were considered. The clerk, in explaining the situation, stated that at the last interview between the solicitor and the company's secretary, it had been indicated that if the Council accepted the company's offer for main street lighting, and the supply of electricity to work the pumps at the sewage works, then the company would come to an agreement in regard to the demands of the Council in the other matters now in dispute, instead of forcing the Council into litigation. The Highways Committee had decided to recommend the Council to accept the Brentford Gas Co.'s offer for a five years' contract for the supply of intensified gas lamps for the main streets at £517 per annum, with the addition of £220 electric light capital charges. Councillor Page moved that, providing the company will agree to supply all street lighting in streets at present lighted by electricity at 2½d. per unit (including maintenance), electricity for the sewage works at 1½d. per unit, and all public buildings at present lit by electricity at 2d. per unit, the Council would be prepared to consider favourably the settlement of the other matters in dispute. Councillor Ince moved that the motion be amended by the insertion of the words after "public buildings" "with the exception of the municipal buildings and public library." Councillor Shilliker protested against any arrangement by which the Council could not have the current for the sewage works during the peak hours, as that would not enable them to deal with storm emergencies. The amendment was carried by 5 votes to 3. Councillor Shilliker then moved that the necessary writs be served upon the company, and the matters in dispute go to arbitration. If the Council, he said, had a right to the £5,000 unexpended balance of loan, then let it be submitted to arbitration. The chairman said he thought it was patent that it was inadvisable to go to law if they could avoid it. He suggested that the following proposal be agreed upon :—"That provided the company accepts the Council's final terms, the company be informed that the Council will be prepared to accept the principle of the supplying of electricity by the company for main street lighting and the sewage pumping station upon terms to be agreed upon between the parties, and that the Electricity Sub-Committee be instructed to arrange a settlement accordingly." This was agreed to.

Argentina.—In connection with the extensions now being carried out at the Ensenada power station of the River Plate Electricity Co., two 3,000-KW. turbo-alternators are under construction by Messrs. Parsons. The existing plant at the Ensenada station consists of two 1,500-KW. Westinghouse turbo-alternators, but as these have proved inadequate to meet the growing demand for current, the additional plant was ordered on the advice of Messrs. Preece, Cardew & Snell. The Parsons turbines, each of which will drive its own alternator, are to be placed side by side in the station, and so arranged that the steam will pass in series from one to the other. Under normal full load conditions, the first turbine will expand the steam from 155 lb. per sq. in. absolute pressure down to about 15 lb. per sq. in. absolute, after which the remainder of the expansion will be carried out in the low-pressure turbine. The two turbines when run together will form one complete unit of 6,000 KW., but the connecting pipes and valves will be so arranged that the high-pressure turbine can also exhaust either direct to the condenser or to atmosphere, when the L.P. turbine is being overhauled, or the latter can be run alone, with the help of a reducing valve. Each turbine will be provided with its own oil pump, speed governor, and runaway governor, and the blading will be of the reaction type throughout. All parts of the high-pressure turbine, which will be exposed to superheated steam, will be made of cast steel, including the central section of the turbine casing. The three-phase alternators will each be capable of giving a normal full load of 3,000 KW., 0·8 power factor, 5,500-6,000 volts, 50 cycles, at 1,500 R.P.M., as well as an overload of

20 per cent. for two hours. Each alternator will be complete with its own exciter, which, however, will be large enough to provide current for the two 3,000-KW. machines.

The municipality of Bolivar received 12 tenders for installing an electric light station. Eight were rejected as not being in accord with the specification. The remaining four are being studied.—*Review of the River Plate.*

Australia.—NEW SOUTH WALES.—A Bill is to be brought before Parliament authorising the sale of surplus electricity generated at tramway power stations to municipalities, and authorising those bodies to erect storage plants or accumulators for power. It is considered that it will pay to sell the surplus power at a much lower rate than is charged by those who manufacture electricity solely for that purpose.

The discussion which has arisen as to electricity supply in North Sydney, seems to favour the placing of the scheme in private hands rather than handing over the business to the Sydney City Council.

Aysgarth.—Subject to the payment of 5s. per year, the Aysgarth R.D.C. has consented to the Electric Light Co. erecting posts in the district for carrying overhead electrical wires.

Barton-on-Humber.—The U.D.C. has accepted the tender of Mr. Hopper, acting for a local syndicate, to light the town with 150 electric lamps of 100 C.P. each, at £2 2s. per lamp per annum for a period of 12 years, subject to the Council having the option to purchase the undertaking during the 12 years.

Beaconsfield.—The Uxbridge Electric Supply Co. has informed the U.D.C. that it intends laying a new main from Uxbridge to Beaconsfield *via* Gerrard's Cross.

Beckenham.—The B. of T. has informed the U.D.C. that it declines to withdraw the powers of the West Kent Power Co. to supply current to the parish of West Wickham. The company has now approached the Council as to the supply of current in bulk to West Wickham by the Council.

Bridlington.—The T.C. has decided to obtain for hiring purposes six complete electric cooking outfits at a cost of £84.

Canterbury.—The T.C. has agreed with the company who carried out free wiring of premises under an agreement with the Corporation, to purchase outright the free-wired installations for £125. The original net cost for the work was £324.

Continental Notes.—AUSTRIA.—Further particulars are to hand of the Vienna municipal scheme for the building of a steam-driven electric station at Ebenfurth, drawing its coal supplies from the neighbouring Zillingdorf mines. The station will be built on the Fischa, and the current will be transmitted a distance of 22 miles to the capital. On the ground chosen a brickworks will be constructed and a railway, making junction with the Vienna-Pottendorf line. The estimated cost, inclusive of the station, office and workmen's dwellings, railway, coal and ash conveyors, cables, switch-houses on the long-distance section, switch and transformer houses in Vienna, brickworks, street installations, &c., is £270,833. The power-house alone will cost £35,416. The scheme has been formally approved by the Vienna Municipal Council.

RUSSIA.—It is reported from St. Petersburg that the St. Petersburg Electric Co. has commissioned a firm in Viborg, Finland, to acquire extended land and water rights on the River Vuozen, with a view to utilising the small Imatra Falls. The company intends to set up a large hydro-electric station there, with an output of between 50,000 and 60,000 H.P., more or less, according to seasons. It is intended to employ a part of the power in Finland, but the bulk will be transmitted to St. Petersburg, where the company owns a large steam-driven electric station. The scheme has been several years under consideration, as the utilisation of water power for the generation of electricity is a pressing necessity for St. Petersburg, in view of any eventual difficulty in the way of obtaining sea-borne coal, either owing to a strike or to international complications.—*Zeit. fur das gesamte Turbinenwesen.*

GERMANY.—A municipal resolution has been voted to acquire in the course of the next three years 1,000 electric cranes for the equipment of the port of Hamburg. A large expenditure is also contemplated on other harbour improvements, including the extension of electric lighting.

Great activity is being shown in various rural districts in Germany in founding electric co-operative societies to supply the members with light and power, and with electrically-driven agricultural implements. The formation of three such societies is lately announced at Weltin, Trestin and Mandelkow respectively, in the Stettin administrative district; five in the province of Pommern, at Lähmannsdorf, Schwaneberg, Messenthin, Neumark, Jährshagen and Flackenheide respectively; others at Ober-Rüdelsdorf in the Lauban Circuit; at Martinswaldau and Bertholdsdorf in Silesia; at Ossig, in the district of Frankfurt on the Oder; at Nieder Zimmern, in Saxon Weimar; and at Oedelum and Schwaförden, in Hanover.

The *Karlsruhe Zeitung* publishes the text of the Bill for the establishment of electric generating stations in the Valley of the Murg by the Government of Baden. The cost, exclusive of interest on the construction capital, and of the outlay on the long-distance transmission lines, is put at 20,771,000 marks. Of the total yearly estimated output of the stations, viz., 35,000,000 KW.-hours, the Railway Department reserves in advance 12,000,000 KW.-hours.

The steelwork of a new power station, which was being erected in a suburb of Nuremberg, collapsed last week, killing ten and injuring 37 men. It is stated that the roof was being tested.

DENMARK.—So far back as 1910 steps were taken to found an electricity supply for the service of the towns and districts on the Danish islands of Lolland and Falster, and the A.E.G., of Berlin, were approached. At the end, however, the negotiations fell through, and six of the several communes in Falster interested, namely, Idestrup, Karleby, Orslev, Horreby, Tingsted and Vaggerlose, decided to carry out separate undertakings. On going fully into the matter, however, the towns named have recognised the uneconomic character of the policy of divided forces, and have resolved to build a joint high-pressure station at Idestrup, at an estimated cost of 370,000 Danish crowns. It is expected that some 30,000 lamps will be connected, and motors up to 1,200 H.P. The plans have been prepared by the firm of Degn & Johansen, of Nykojung, on the Island of Falster.—*Elektr. und Maschinenbau.*

ITALY.—Negotiations are in hand in connection with the formation of a co-operative undertaking to establish a central electric lighting and power station in the town of Sestri Ponente.

Doncaster.—The Corporation Electricity and Tramways Committee has received a communication from Messrs. H. Hay and Co., of Bradford, asking at what price current for power would be supplied if they decided to erect a spinning mill at Doncaster. A Committee has been appointed to go fully into the matter.

Edinburgh.—Treasurer McLeod, in submitting the estimates of expenditure for the year at a meeting of the T.C. last week, said, as regards the electricity estimates, it was proper again to remind the T.C. that the estimated balance available at the end of the year was only £190, which on a turn-over of £135,000 seemed to be working upon a very narrow margin, and it was a question for serious consideration whether the present low rate for electric light could be maintained. The margin provided for left no room for contingencies arising throughout the year, without encroaching upon the reserve fund, which it was very desirable should be left intact. Bailie Fraser asked, if there was a deficit on the electric accounts, who had to make that good—the rates or the reserve, and the treasurer stated the reserve.

At the same meeting the following notice of motion was given:—Remit to the Electric Lighting Committee to consider and report as to the disposal of the ascertained surplus of £2,179 on the year's accounts of the electric light up to May 15th last.

Ellesmere Port and Whitby.—The U.D.C. has decided to apply for a prov. order for electric supply.

Gillingham (Kent).—The T.C. has entered into an agreement to supply current to the Royal Naval and Marine Orphan Home.

For public lighting the Council has fixed a charge of 35s. per 55-watt lamp, producing £1,436 15s. per annum.

Gloucester.—The T.C. has agreed to pay £20 to the National Electric Construction Co., Ltd., in settlement of the free wiring work installed in the city by the company.

Henley-on-Thames.—Messrs. Horace Boot & Partners have informed the T.C. that they intend applying, on behalf of the company to be formed, for a prov. order for electric supply for the borough.

Holywell.—With the extension of the premises of the Welsh Flannel Co., at Holywell, an electrical plant was installed, and this was set working last week. The plant provides electrical current for the motors driving the whole of the weaving looms, numbering 180, and also the spinning machinery, and supersedes a combination of gas, steam and water-power. Two new engines of 200 and 100 H.P. respectively were supplied by Messrs. Beliiss, and the dynamos by the Lancashire Dynamo and Motor Co.

Inverary.—Arrangements are being made for the introduction of electric light to Dunderave Castle, Argyllshire. It is hoped in the burgh of Inverary that it may be found possible to make an extension to the town.

Kingswood.—The B. of T. having intimated that it intends revoking the Electric Lighting Order, 1904, owing to the deposit of £500 not having been made and no compulsory works having been executed by the promoters, the U.D.C. has decided to support an application by the Electric Supply Co. for an extension of time, for the company offers to give a temporary supply of current by the end of September, and a permanent supply by the end of the year.

Kippax.—Negotiations are proceeding between the P.C. and the Yorkshire Electric Power Co. for a supply of current to the parish for lighting purposes.

Leatherhead.—The Leatherhead and District Electricity Co. is applying to the B. of T. for an extension of powers so as to cover the parishes of Stoke d'Abernon, Cobham, Great Bookham and Little Bookham.

Leeds.—The Electricity sub-Committee of the Corporation recommends that application be made to the L.G.B. for sanction to borrow £10,000 for the purchase of electric motors to be let out on hire. It is proposed that the motors shall range in power from ½ to 10 H.P. for single-phase motors, except by special arrangement with the manager. Arrangements will be made for the hirer to purchase the motor, if desired.

The City Council has agreed to reduce the maximum price of electricity for lighting purposes from 4d. to 3½d. per unit. As our

readers will know, the Corporation electricity department felt the effect of the metal lamp very severely for some years, but apparently matters have now reached a normal state again.

Leicester.—The T.C. has confirmed the recommendation of the Tramways and Electricity Committee that application be made to the B. of T. for a provisional order to extend the limits under which the Corporation is authorised to supply electricity, so as to include the districts of New Parks, Oadby, Evington, Humberstone and Birstall.

London.—In the report of Mr. Frank Sumner, City engineer to the Corporation of London, for the year 1911, it is stated that there were 470 electric lamps in use on December 31st, of which 332 were ordinary open arcs, 92 flame arcs, and 46 metallic-filament lamps, mainly of 75 and 100 c.p.; there were 81 reported defects during the year. The gas lamps numbered 2,648, and there were 2,054 defects reported. The experimental electric and gas lighting was continued, and arrangements were made with the City of London Electric Light Co. and the Gas Light and Coke Co. to share the lighting of the City, at a saving of £6,830 per annum on the previous total of £20,873, and with an increase in illuminating power of about 600,000 c.p.

Hammersmith.—The income of the electricity undertaking for the year ended March 31st last amounts to £62,745, as against an expenditure of £32,095, leaving a gross profit for the year of £30,649, which represents a percentage of 8·92 upon the amount of capital expended, as against 10·5 per cent. last year. After adding £284 to this amount for interest on bank balances, and allowing for interest on mortgage debt for the year (£8,737); redemption of loan capital (£13,567); provision for accruing loan charges (£375); and £54 as irrecoverable, there remains a net surplus for the year of £8,307, as against £12,033. The following amounts were realised from the sale of current at the prices mentioned:—3½d. per unit, £374; 3d., £25,588; 2·1d., £2,095; 2d., £2,340; 1¾d., £4,235; 1½d., £4,342; 1¼d., £7; 1·1d., £163; 1d., £13,704; ·9d., £1,349; ·8d., £936; ·4d., £1,150. During the year under review 10,903,650 units were generated and 461,470 purchased, as against 10,787,120 and 584,898 last year. Of the total quantity sold (9,335,892) 8,525,613 went to private consumers by meter, the revenue obtained therefrom averaging 1·58d. per unit, the increase over 1911 being comparatively small, the total number then sold being 8,455,665, or an average income of 1·61d. per unit. The current used for lighting public lamps totalled 810,279 units, and the income from their sale realised £4,552. The maximum demand during the year amounted to 5,828 kw. A further sum of £3,360 has been contributed by the undertaking, during the past year, in relief of the rates, this amount being equivalent to 1d. in the £. The total amount so contributed during the existence of the undertaking is £10,360. The accumulated surplus standing to the credit of the undertaking at March 31st last was £8,826, which amount has been arrived at after defraying £3,139 of capital expenditure from revenue, and writing off £6,944 in respect of scrapped machinery and plant.

Islington.—The special committee appointed to consider the advisability or otherwise of introducing electric light and power into the several institutions under the control of the Guardians, reports that it has received and considered reports from the Gas Light and Coke Co. as to the advantages of improved methods of gas lighting and the economy that could be effected, also full and detailed reports from Mr. J. Enright, consulting engineer, as to the saving in lighting by electricity, and the benefits in convenience, cleanliness and greater efficiency in using electric power. It had also communicated with the borough electrical engineer as to the lowest terms upon which current could be supplied, with the result that the B.C. would be prepared to supply at a uniform rate of 2d. per unit, upon the conditions: (1) That the supply is brought into each building at a point as near the roadway as possible. (2) That an agreement is entered into for a period of five years. (3) That during that period of five years an aggregate amount of energy for power purposes be taken of 200,000 units, that is, an average of 40,000 per annum. Taking the cost of the two systems it appears there will be an annual expenditure of £827 if electricity were adopted as against £1,043 for gas. Adding the cost of power to the electricity total the annual expenditure amounts to £1,305 as against £1,355 after adding the estimated cost for cooking on the gas total. The cost of installation of the electric scheme is put at £2,430. The Committee recommends that the L.G.B. be asked to sanction the installation of electricity for light and power, and that Mr. Enright be employed to prepare plans, specifications, &c., and to supervise the works at a commission of 5 per cent. on the expenditure.

Manchester.—The City Electricity Committee proposes to provide additional plant at its various works at an estimated cost of £87,160.

Nottingham.—The City Council has had before it a report of the Electricity Committee, embodying reports of Mr. B. M. Jenkin and Mr. W. H. Patchell, concerning the condition of the plant at the Corporation generating stations. The Committee pointed out that these reports showed that the plant is in good condition, and although not so efficient as more modern plant, they did not advise that it should be scrapped, and replaced by plant of the latest type, owing to the very large expenditure that would be involved. The Committee had come to the conclusion, after careful consideration of the experts' reports and the advice previously given by Mr. Talbot, the electrical engineer, that the most satisfactory way of dealing with the existing plant, was to install an exhaust steam turbo-generator with condensing plant at the St. Ann's Well power station, where was sufficient room for erecting the necessary cooling towers. With this plant it would be possible to supply the bulk of the day load required for lighting and power purposes, and effect a large saving in the consumption of coal. It was estimated that the approximate saving on the cost of generating electricity, based on last year's output, would be about £3,000 per annum. The total cost of installing this plant would be about £17,140, and it was proposed to provide that amount out of the reserve fund of the electricity undertaking, which now stands at £44,685. The Committee was of opinion that the other suggestions in the reports of the experts would be difficult and costly to carry out. It did not, therefore, propose, as at present advised, to make any alterations at the Talbot Street or the Eastcroft power stations as the former station would only be worked for a short time in the evenings and during the winter months.

In moving the adoption of the report, Sir John Turney, chairman of the Committee, said the recommendations had been brought about by the changed condition of things in the production of electric current. Bad as the undertaking had been for the Council, continued Sir John, in satirical vein, he realised that if instead of the Finance Committee taking the surplus earnings of this undertaking year by year the Electricity Committee had been permitted to put the money to the reserve fund, in place of a reserve of £45,000, they would have had practically £160,000, and would have been in a position to scrap the present machinery.

The motion for the adoption of the report was seconded by Major Ashworth, who expressed the opinion that in future more money should be placed to the reserve.

Mr. W. Hobson criticised the proposals, describing them as patch-work. To spend £17,000 in putting a new patch upon an old coat was, he thought, against all business principles. They would save £3,000 a year, and it would take six years to get the money back, whilst the alterations would only depend upon the life of the engines and plant. He suggested that the whole of the £44,000 in the reserve fund should be expended in fitting the Talbot Street station with up-to-date engines.

Alderman Ball referred to the proposal he brought before the Council several months ago for utilising the Colwick and Beeston weirs in the River Trent for the generating of power. "I was laughed at," said Mr. Ball, "when I introduced it, but many a good thing and many a good man have been laughed at. I am satisfied the scheme is worth consideration."

Sir John Turney replied that the expert had had to delay his report upon Alderman Ball's scheme, but he thought it would be a very interesting one when it did come. He thought it would enlighten Mr. Ball.

After further discussion, the report was adopted.

Portishead.—Messrs. Christy Bros., the promoters of the electricity scheme for the district, have applied for three months' extension from August, as they cannot complete the generating station and light the streets by that time.

Rickmansworth.—Mr. R. E. H. Fisher and the Colne Valley Electric Supply Co., Ltd., have applied to the Council for permission to supply electricity to Rickmansworth. The Council has deferred consideration pending the receipt of full particulars.

Shanghai.—Referring to a note in our issue of June 14th, reviewing the annual statement of the Shanghai Municipal Electricity Department, the electrical engineer, Mr. T. H. U. Aldridge, writes to point out that Shanghai is not a Chinese city in the sense that other cities throughout China are; it is an international settlement administered by a municipal council consisting of nine foreigners, seven of whom are British, one American and one German. The Chinese authorities have practically no jurisdiction in the International Settlement, the whole of the municipal administration being under the municipal council, which is elected by the foreign ratepayers, and by the Consular body of the various foreign powers.

Shipston-on-Stour.—With reference to the electricity scheme for this parish, a provisional order is to be applied for by Messrs. Brown & Parsons, Ltd., of Leamington, and the R.D.C. has agreed not to oppose the application.

South Africa.—About four months ago arrangements were made between the Cape Town City Council and the Municipalities of Mowbray, Claremont and Rondebosch, whereby the Council by purchasing the Cape Peninsula Lighting Co.'s undertaking was able to considerably enlarge the supply area of the city's municipal electrical system, which now extends from Sea Point to the boundary of Wynberg. With a view to economy in generation, it was decided to shut down the power station at Claremont, and with this end in view considerable extensions to the plant at the Dock Road power station are now in progress.

The Corporation has made arrangements for the installation of a 2,000-kw. turbine set. This turbine plant, which is the first of any size to be installed in the peninsular, will be sufficient to meet the whole of the demand in the peninsular from Sea Point to Wynberg, and will be in operation daily from about 8 a.m. to 12 midnight, the present reciprocating engines only being used during the early hours of the morning and on Sundays when the load is not sufficient to run the turbine efficiently. The present plant will also be kept in reserve as a stand-by in the event of the failure of the turbine.

The supply in the southern suburbs of Mowbray, Rondebosch and Claremont is at present direct current, but this will be changed over to alternating current so soon as the generation is undertaken

from Dock Road. The set on order for the Council consists of a turbine direct coupled to an alternating-current machine, and in order to make this plant available for the present direct-current supply in the City area, the order has been placed for a 1,000-KW. Peebles-La Cour motor-converter, and this will be in operation whenever the turbine is running. The generating plant is being further augmented by the installation of an additional boiler of 1,000 H.P. capacity, and a Green economiser.

The high-tension supply to the suburbs will be at 11,000 volts, and a sub-station is now being constructed at the power station, which will accommodate the necessary transformers and switch-gear; the plant in this sub-station will transform energy from 2,200 volts (the pressure now in use for Sea Point and a portion of the Government bulk supply), to 11,000 volts; and from the sub-station cables in duplicate will be laid as far as Claremont. These cables will enter sub-stations at Mowbray, Rondebosch and Claremont, where the 11,000 volts will be reduced to 220 volts, at which pressure energy will be distributed through the various streets for public lighting, and the supply to private consumers of light and power.

In addition to the supply to the sub-stations referred to above, these cables will also supply energy to Messrs. D. Mills & Co.'s mills, Castle Bridge, with whom the Council has made an arrangement for bulk supply and the suburban waterworks at Rondebosch, where electrically-driven pumps are replacing the existing suction-gas-driven plant; at the moment negotiations are in progress with a view to the supply of energy for the electrification of Salt River Works, which, if carried through, will necessitate a further sub-station at Salt River. The total cost of the new machinery is between £20,000 and £30,000. The high-tension mains for the new supply to the municipality of Wynberg are now being erected between Muizenberg and Wynberg, and it is expected that the supply will be available about September.

According to the local press, it was resolved at a meeting of the ratepayers of Cradock, Cape Province, to instruct the T.C. to take immediate steps to light the town with electricity at a cost not exceeding £10,000.

Tunbridge Wells.—The T.C. having applied for an order to authorise current to be supplied to three premises at Speldhurst, the B. of T. has asked to be supplied with information that the occupiers of the premises are desirous of obtaining the supply from the Corporation. Copies of the applications received by the Council have been forwarded to the B. of T.

The L.G.B. has withheld sanction to a loan of £6,000 for mains, sub-station pillars, transformers and house services, pending information that the sum named is not excessive for the next three years.

Warrington.—The borough electrical engineer, Mr. F. V. L. Mathias, reports that the income of the electricity department for the year ended March 31st was £19,245; working expenses were £11,536, and the gross profit was £7,709; after paying capital charges there remained a net profit of £1,746. There was a slight decrease in the units sold, the meters having been read earlier this year. The use of turbo-generators during part of the year reduced the coal consumption per unit from 5·8 lb. to 4·6 lb. The units sold amounted to 3,187,379, of which 2,217,518 were for power.

Watford.—Of the sum of £2,122, being the profit of the electric light undertaking during the past year, £850 is to be allocated in aid of the district rates, and £1,272 to the reserve fund.

West Bromwich.—The T.C. has decided to extend the mains at a cost of £200 in order to supply current to the works of Hamblet's Blue Brick Co., Ltd.

A further extension of mains, to cost £1,000, is to be carried out to supply the district of Harvills Hawthorn, and Tame Street, Hill Top.

Witham.—The U.D.C. has agreed to lease for 15 years to Messrs. Crompton & Co., the old waterworks premises for use as a generating station, at a rental of £30 per annum.

Womersley.—Electrical plant is being installed at the Parish Church for lighting and blowing the organ.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Campania La Comercial, owners of the tramway in Concordia, are now studying the question of electrification, to see if this will suit their requirements.

Australia.—According to the secretary of the Prahran Malvern Tramways Trust, there are over 38 track miles of municipal (electrical) tramways in Melbourne, where there are also 88 track miles of cable tramways in use. It is proposed to construct a further 3 miles of route in South Melbourne, the power being supplied by the City Council or Supply Co.

A conference of representatives of the northern municipalities of Melbourne has been held to consider the route of a proposed cross-country tramway from Essendon through Brunswick to Northcote and Preston, linking up six municipal areas.

Birmingham.—It has been arranged that an application shall be made in November next for a light railway Order for the construction of a tramway from Baldon Road to Quinton.

The City Tramways Committee has been authorised to consider and report to the next meeting of the City Council on the advisability of installing a service of railless cars from the centre of the city to Harborne.

Blyth.—An expert report on a proposed local tramway scheme has been issued to the members of the U.D.C. Having regard to the population, the reporter is of opinion that the cost of ordinary street tramways would be prohibitive, but that a motor-'bus service could be run for an outside figure of 10½d. per 'bus-mile if a guaranteed mileage of 450 per week per 'bus were made the terms of the contract. The report is to be considered at the next meeting of the Council.

Colne.—At the Council meeting on July 31st, the town clerk submitted a report by the General Purposes Committee upon the negotiations with the directors of the Colne and Trawden Light Railway Co. for the purchase of the undertaking which the company is desirous of selling. It was resolved that such report be adopted and filed, and that the town clerk be instructed to confirm the special terms offered by the sub-Committee.

Continental Notes.—GERMANY.—Plans are being prepared in respect of a projected electric tramway to connect the towns of Ludwigshafen and Kaiserslautern.

The Elektricitäts Unterelbe Actien-Gesellschaft has been registered, with a capital of 6,500,000 marks, with the object of taking over the Altona-Blankenese electric tramways, the Altona generating station, the supply of light and power current in that city, and also to Nienstedten, Klein Flottbeck, &c., for a period of 40 years, on the basis of an arranged tariff.

AUSTRIA.—The negotiations connected with the electrification of the Vienna municipal railway and the construction of tube lines are making steady, if slow, progress. Differences of opinion prevail between the Vienna group and the French group as to the need for a State subsidy, the latter deeming it unnecessary so far as the tube lines are concerned, as they promise to be sufficiently remunerative. The conclusion which will, it is presumed, be eventually arrived at is that the Vienna group will carry out the electrification of the municipal railway, leaving the undertaking of the tubes to the French group.—*Der Elektrotechniker.*

The negotiations regarding the electric local line from Vienna to the Austrian frontier through Hainburg have been concluded by the granting of the concession. The Lower Austria Provincial Council is the concessionaire, and will hand over its rights and duties to a company which is to be formed. The cost of the line is put at £541,666. A portion of the projected route utilises existing lines, and at its termination, the line will join the frontier station of the Hungarian railway from Pressburg. The line will provide a new and speedy access from the Danube rural districts to the markets of the centre of Vienna, thus facilitating the better provisioning of the city.

ITALY.—On July 1st the Milan-Gallarate-Varese line was opened for electric working, the new double trains which have been rendered possible by the transformation of the line being destined to improve the working of the traffic. The current will be supplied from the hydro-electric station at Varzo, which has 30,000 H.P. It is transmitted to Gallarate at a pressure of 45,000 volts, where a portion is transformed into continuous current at 650 volts, and fed to the third rail, the remainder, still at 45,000 volts pressure, being diverted towards Milan and Varese, where, after being transformed to continuous current at 650 volts at the sub-stations at Basto Arsizio, Parabiago, Rho, Boviso, Albizzate, and Gazzada, it is fed to the third rail on those sections. It is expected that by the coming autumn, five powerful locomotives of 1,500 to 2,000-H.P. capacity, now in course of construction, will be ready for service.—*L'Ingegneria Ferroviaria.*

SWITZERLAND.—A railless electric motor-train (system Schiemann's) is to be installed on the Cauta Berne, on a 10-km. line from Herzogenbuchsee to Wangen and Wiedlislac. The service will consist of three motors and three trailers, and will carry passengers, goods and mails. Current at a pressure of 100 volts will be used.—*Electro.*

TURKEY.—The Canea municipal authorities are open to receive tenders for a concession to install an electric tramway system. Particulars of the municipality.

RUSSIA.—A company, styled the Tramways and Electric Enterprises of the Suburbs of St. Petersburg, has been formed to electrify existing lines and build extensions in the suburbs of the Russian capital. The population to be catered for numbers 270,000 in winter and 360,000 in summer. The new company will not interfere with existing companies, and notably with the Electric Light Association, of St. Petersburg, or the Eclairage Electrique de 1886, as its scope is wholly confined to the suburbs.—*La Lumière Electrique.*

Plans are being prepared in respect of a projected electric tramway between Riga and Majorenkof, a distance of 9½ miles.

NORWAY.—H.M. Consul further reports, on the authority of the local press, that it is expected that the existing private trackless electric traction system at Drammen will be replaced by a tramway system.

A Bill is being introduced for the electrification of the entire railway section between Christiania and Drammen; the Randsfjord section is to be reconstructed.—*Board of Trade Journal.*

Chile.—The Government has sanctioned the laying down of a new electric tramway line from Santiago to Penaflor.—*Review of the River Plate.*

Coventry.—Application is to be made to the B. of T. for a loan of £20,475 for the purchase of additional cars, the extension of the car-shed, and the provision of additional passing places. Later the Committee will consider the matter of extension of lines and diversions and other work connected with general routine.

Croydon.—The T.C., on the recommendation of the Tramways Committee, has decided to seek Parliamentary powers to run motor-omnibuses.

Dundee.—It was reported to a meeting of the Corporation Tramways Committee that the route for railless traction at the east end was now completed, and that the plant and equipment were almost ready to be sent north. The new system will be opened for traffic in a month. The fare for the route, which extends to fully a mile, will be 1d., with intervening ½d. stages.

Gloucester.—On the tramways during the past year there has been an increase of over £1,000 in the receipts, and of more than a quarter of a million in the passengers carried. The working expenses were the lowest since the tramways were inaugurated, and the lowest of any tramway in the country. The current consumption showed a reduction of 23 per cent. owing to the introduction of car-meters and the bonus system. The gross profit of £4,700 was the largest in any one year, and enabled the Committee to pay off £1,077 of a long-standing debt. The business of the parcel system has increased by 65 per cent. in four years.

Halifax.—The B. of T. has sanctioned the borrowing by the Corporation of £3,750, repayable in 15 years, for the purchase of six new cars for use on the tramways.

The Tramways Committee has decided to serve notices upon the owners and occupiers of premises in Waterhouse Street of the intention of the Corporation to lay down in that street double lines of tramway, in lieu of single lines, and also to apply to the B. of T. for consent to such doubling.

Lancs. and Yorks. Railway Electrification.—A start has been made in electrifying the branch line from Bury to Holcombe Brook. The track, which is over three miles long, is of a very hilly nature, and it is intended to work the line with a high-pressure D C. electrical equipment. A start has been made with the relaying of the track, part of which includes the main line to North-East Lancs. It is expected that the new system will be commenced before Christmas, and, according to our correspondent, it is intended eventually to extend the system from Bury to Manchester, and afterwards to other Manchester suburban lines as early as possible, with a view to meeting the keen competition of the tramways.

The same correspondent also states that the electric system between Southport and Liverpool has been such a pronounced success that the company has decided to construct two fresh sets of electrified lines into Exchange Station, Liverpool. In order to cope with the increasing passenger traffic from the Southport line, the company has also decided to continue the electrification of the railway from Town Green to Ormskirk, thus linking up the line from Liverpool to Ormskirk with the live rail. It is expected that the new work will be completed before the end of the present year. In addition, the train service between the two places is to be greatly supplemented.

Leicester.—In order to cope with exigencies of the traffic, the Corporation has decided to purchase 10 additional tramcars, at an estimated cost at £7,000, the cars to be on the "pay-as-you-enter" principle.

Llandudno.—The B. of T. has confirmed the Llandudno and Colwyn Bay Light Railway (Extension No. 2) Order of 1912.

New Zealand.—The ratepayers of Invercargill have sanctioned by poll proposals to borrow sums of £15,000 for the completion of electric tramways and £10,000 for the installation of a lighting and power plant.

The municipality of Thames has decided, on a poll of the ratepayers, to expend a sum of £14,000 on the installation of electric light.

The ratepayers of Palmerston have agreed to the proposal to borrow £60,000 for the construction of an overhead electric tramway system at that place.—*Board of Trade Journal.*

North-Eastern Railway.—The accounts of this railway for the past half-year contain the following figures respecting the electrical section :—

	Half-year, June, 1912.	Half-year, June, 1911.
Passenger train-mileage	564,934	597,953
Goods "	2,477	2,569
Passenger car-mileage	1,873,094	1,892,439
Revenue expenditure	£16,218	£16,168

South Africa.—The proposed Johannesburg-Pretoria electric railway is again attracting attention, largely, no doubt, on account of the cheap power now available.—*African Engineering.*

Stockport.—The Corporation has now ordered three railless cars. The system adopted is the Bremen, and is in service at Bremen, Ludwigsberg, Braslau, and Brockau. The two overhead wires are in vertical parallel. The current collector consists of two trolley wheels running on the upper (negative) wire connected to a double sliding bow, which is kept rubbing by spring pressure against the lower (positive) wire. Below is first a swivel joint enabling the current collector to be freely turned, and beneath that a sensitive spring loop which interrupts all shocks and vibration caused by uneven road surface. There is no trolley pole, but in lieu thereof a flexible cable. The type of 'bus adopted is provided with a single electric-motor, which is used to drive the back axle through worm gearing. Starting, stopping, and changing speed, are done by means of a lever operated by the left foot. The ordinary brake is worked by the right foot, and the driver has nothing to do with his hands except to steer the vehicle, save on rare occasions when he uses the emergency brake.

U.S.A.—According to the *Times*, the New York, Winchester and Boston high-speed suburban electric railway, a connection of the New York, Newhaven and Hartford line, has been brought into service.

West Bromwich.—At a meeting of the T.C. last week, it was reported that the Local Government Board had sanctioned a loan of £4,500 being obtained for removing the tramway poles from the centre to the side of the road. It was also stated that the South Staffordshire Tramways (Lessee) Co., Ltd., had consented to the alteration on certain conditions which the Council were recommended to accept. The Mayor said they hoped to proceed with the work forthwith. The report which was presented by the Highways Committee was approved by the Council. When the alterations are completed, the tramway service will be considerably accelerated. The Mayor told the Council that this was the first occasion the L.G.B. had treated the removal of tramway poles from the centre of the road as a street improvement.

Wolverhampton.—The T.C. last week sanctioned the expenditure by the Tramways Committee of £5,860 for the extension of the tramcar depôt, this sum including the cost of the new building, together with the tracks, plant, &c. The expenditure is to be borne by the Tramways reserve fund.

TELEGRAPH and TELEPHONE NOTES.

Australia.—Litigation regarding the system of wireless telegraphy employed by the Commonwealth Government is still in progress. The Marconi Wireless Telegraph Co., which had brought an action for infringement against the Government, applied to the Court for an order for the inspection of the Government's apparatus, which was refused; on appeal to the High Court, the Postmaster-General put in an affidavit to the effect that to allow any such inspection would be prejudicial to the public interest, that the system employed was the invention of Mr. J. G. Balsillie, and that it was the intention of the Government to apply for letters patent for the invention of the system employed at the stations at Melbourne and Hobart within three months (from June 25th). The hearing was adjourned to enable the Government to patent the method.

Automatic Telephony at the G.P.O.—On Friday last, at the invitation of the Automatic Telephone Manufacturing Co., Ltd., we had the pleasure of inspecting the automatic exchange at the General Post Office, London, which has just been completed by the company, on the Strowger system. The exchange provides for some 350 lines, and serves the group of Post Office buildings which dominates this portion of the city; it is housed in a remarkably small space in the basement of the G.P.O. West. As some of the lines serve private branch exchanges, there are in all some 800 telephones working through the "official switch" as it is called. Over 10,000 calls were registered on the first day of its operation. We understand that in the view of the Post Office, its performance so far has been admirable, and after watching its industrious operations for an hour, we can well believe it. The mechanism is of fascinating ingenuity, and appears to fall but little short of thinking; it seems to be prepared for every conceivable contingency that may arise in ordinary working, short of violent disruption; the occurrence of a defect of any kind is immediately signalled, as in the human subject, by a rise of temperature (in a coloured incandescent lamp) accompanied by an audible complaint, and these symptoms have the advantage that they indicate to the medical attendant the nature and situation of the trouble far more definitely than is often the case with the human patient. Moreover, a series of optical signals is provided, which enables the attendant to watch the normal working and almost to anticipate a possible failure. It must be added, in fairness, that the numerous signals of trouble recorded during our visit were artificially produced by the officials in order to demonstrate their operation. A very complete description of the system, which has also been installed at Epsom, was published in the *Post Office Engineers' Journal* recently; it was also described in the paper read before the Institution of Electrical Engineers by Mr. W. Aitken last year, and abstracted in our issues of June 23rd and 30th, 1911. The order for a similar installation, serving 6,800 subscribers, for Leeds has been placed with the Automatic Telephone Mfg. Co. by the Post Office, which indicates that the latter is satisfied not only with the technical efficiency of the system, but also—what is of equal importance—with the commercial results obtained. The use of the automatic principle enables a call to be put through in less than four seconds; after that, it is the fault of the called subscriber if delay ensues in obtaining a reply. The average time occupied in getting through on the manual system is about 16 seconds. There is no possibility of the delay in obtaining the attention of the operator, which is often so irritating, as the caller is "through" the moment he has completed his prescribed

cycle of operations. When a person is called up on the manual system, he may unkindly take his own time in answering the bell, knowing that the delay will probably be ascribed to the operator; but with the automatic this subterfuge is inadmissible, as the caller knows that the delay must be due to the subscriber, and can take him to task therefor. Another great advantage is the instantaneous cut-off the moment the calling subscriber has hung up his receiver; this obviates a most annoying cause of loss of time and of the use of the instrument, and also relieves the junctions to a great extent.

Dundee Telegraphs.—The Postmaster-General has written the Chamber of Commerce that he does not feel justified in recommending expenditure for the extension of the underground telegraph from Edinburgh to Dundee. The work was estimated to cost £70,000. Great dissatisfaction exists among business men, as the present exposed wires during the time of storm are frequently out of order and great inconvenience results. The directors of the Chamber of Commerce will continue to agitate for the underground system.

Imperial Wireless Stations.—The South African Government has agreed to take part in the Imperial scheme, and has selected a site at Pretoria, where a long-distance station will be built on the same lines as the others composing the chain. The cost will be £80,000, which will be borne by the Union Government.

The discussion on the agreement between the P.M.G. and the Marconi Co. in the House of Commons has been postponed until after the vacation. According to a statement made by Mr. Samuel on Wednesday last, when the Government decided to embark upon an Imperial system a special Committee was formed to consider the enterprise, comprising representatives of the various Governments and the High Commissioners of South Africa, Australia and New Zealand. It was thought inadvisable for the Government to attempt to carry out the work without the aid of a contractor experienced in long-distance telegraphy, and it was useless to invite tenders, as no company except Marconi's had the necessary experience. Negotiations with the Marconi Co. were therefore opened, and the special Committee was kept fully informed as to their progress at every stage. The cost of each station (£60,000, exclusive of sites, foundations and buildings) was not considered excessive by the experts on the Committee, in view of the high power required, and the fact that each of the stations other than the terminal ones would have to be completely duplicated for duplex working; the steel masts alone, of which 30 will be required for each station, 300 ft. high, are estimated by the Post Office engineers to cost £30,000 per station. No monopoly is created by the contract; the Government reserves the right to install additional apparatus other than Marconi's if it pleases, and can at any time substitute another system altogether which does not infringe the Marconi patents, whereupon the royalty payable to the Marconi Co. will cease. It was impossible to lay the contract before Parliament at any earlier date than the day on which it was signed (July 19th), as many points of detail remained to be settled when the agreement was arrived at in March.

Strong opposition to the agreement has been evinced; in particular, Major M. Archer-Shee, in Parliament and in the Press, has raised objections to the contract and to the statements of the P.M.G., and demands an inquiry by a Select Committee.

Norway.—The Norwegian Telegraph Department intends to include in the estimates for 1913-14 the necessary amount for the erection of a radio-telegraphic station a few miles north of Christiania, on a height known as Tryvandshöiden, about 1,800 ft. above sea-level.—*Board of Trade Journal.*

Portugal.—The provisional contract entered into between the Government of the Portuguese Republic and Marconi's Wireless Telegraph Co., for the erection of wireless stations in Portugal and Portuguese possessions, has been ratified by Parliament, and considerable extensions have been made therein.

War Office.—Col. Seely has appointed a Committee to consider recent developments in wirelesss telegraphy, and the application of these developments to the needs of the Army.

West Africa.—Wireless telegraphic communication has now been established in the Congo between Boma, Elisabethville, Kindu, Kongolo, and Stanleyville.—*African Engineering.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—August 28th. Common-battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" July 26th.

September 25th.—Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

October 2nd.—N.S.W. Government Railways. Six 1,000-kw. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

Austria.—Vienna.—November 30th. Plans are required for the erection and working of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

Batley.—August 23rd. High-tension cables, for the Corporation. See "Official Notices" August 2nd.

Bedwas.—September 5th. Electrical goods for a year for the Bedwas Navigation Colliery Co., Ltd. (Form 4). The Secretary.

Canary Islands.—August 22nd. The municipal authorities of Arresife de Lanzarote (Canary Islands) are inviting tenders for the concession for the electric lighting of the town during a period of 30 years.

China.—August 13th. High and low-tension sub-station switchgear, for the Shanghai Municipal Council. See "Official Notices" July 26th.

Costa Rica.—December 9th. Tenders will be received for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

Doncaster.—The general manager of the Corporation Tramways has just invited tenders for the supply of a 30-h.p. petrol motor-tower wagon for use in connection with the maintenance of the overhead conductors.

Gateshead.—August 10th. Installation of electrical plant at the new lunatic asylum at Stannington, for the Visiting Committee. See "Official Notices" August 2nd.

Hungary.—Beszterebanya.—August 24th. Tenders are invited for the supply of a 500-h.p. crude-oil engine with accessories, a three-phase generator and a switchboard with connections. Deposit 5 per cent. Particulars (5 kronen), Ingenieur Tibor Szeberenyi, Josef-utea 12, Budapest VIII.

Dunafoldvar.—August 16th. Tenders are invited for the erection of a generating station. Particulars from the municipal authorities.

Leeds.—September 9th. Paper-insulated cables, for one, two or three years, for the City electric lighting department. See "Official Notices" to-day.

London.—L.C.C.—August 23rd. Electric lighting bells and telephones at the County Secondary School, Plumstead, S.E. See "Official Notices" to-day.

Manchester.—September 10th. One 12,000-kw. three-phase high-pressure turbo-alternator, with condensing plant, &c., water-tube boilers and superheaters, economisers and coal chutes, for the Corporation. See "Official Notices" to-day.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Shipley.—August 14th. (*a*) One 300-kw. rotary converter with e.h.t. and l.t. switchgear and (*b*) supply and laying of e.h.t. cables, ducts, telephone cables, &c., for the U.D.C. Mr. S. D. Schofield, electrical engineer, Dockfield, Shipley. (Returnable deposit for each contract of £1 1s.)

South Africa.—September 11th. Durban Corporation. One-ton electric storage battery vehicle. A statement on the matter can be seen at the Board of Trade C.I. Department, London, E.C.

Cradock.—A meeting of ratepayers of Cradock was recently held, when it was resolved to instruct the Town Council to take immediate steps to light the town with electricity, at a cost of £10,000. A letter received by last mail says that tenders were to be advertised for at once.

Spain.—Madrid.—October 22nd. Concession for installation and working of an electric light service for 15 years. Deposit, 5 per cent. of the offer, eventually 20 per cent. Particulars from Hotel de Ville, Madrid.

August 16th.—The Spanish Post and Telegraph authorities in Madrid are inviting tenders until August 16th, for the concession for the establishment of a telephone exchange in the town of Castro Urdiales (Province of Santander) and for the working of the same during a period of 15 years.

CLOSED.

Australia.—The Reason Manufacturing Co., Ltd., of Brighton, have, through Messrs. McIlwraith, McEacharn & Co., of London, secured the Melbourne City Council's contract for 600 electrolytic meters, namely, 2½, 5 and 15-ampere sizes.

Bath.—Messrs. Stothert & Pitt, Ltd., have secured a contract for an electric traverser for goods' wagons at Moor Street G.W.R. Station, Birmingham.

Canterbury.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son for a year's supply for coal for the electricity works, at the following prices :—

Nixon's Navigation large steam, £1 10s. 8d. per ton; Rochester house coal, 18s. 1d. per ton.

Croydon.—The T.C. has accepted the tender of the Easton Lift Co., Ltd., for an electric lift for the Town Hall, at £118; that of Messrs. Babcock & Wilcox, Ltd., for pipe work, steam and exhaust connections, and erection of valves at the E.L. works, at £525; and that of Messrs. J. Hopkinson & Co., Ltd., for valves, at £260.

The Education Committee has accepted the tender of Mr. Sydney Hunt, Croydon, for installing the E.L. at South Norwood Schools, at £50.

Dewsbury.—The Electricity and Tramways Committee has accepted the following tenders :—

Brush Electrical Engineering Co.—1,000-kw. turbine and generators.
W. H. Allen & Co., Ltd.—Condensing plant

Dublin.—Messrs. W. Coates & Sons, Ltd., have secured the triennial Board of Works contracts for all electrical supplies and work in all Government offices and institutions in Dublin and its vicinity.

Folkestone.—The contracts for the lighting installation and the cable work for plant and batteries at the *Folkestone Herald* printing and bookbinding works, for Messrs. F. J. Parsons, Ltd., have been awarded to Mr. E. Arthur Pinto, A.M.I.E.E., of Hythe and Dover.

Halifax.—The Tramways Committee has accepted the tender of the Brush Electrical Engineering Co., Ltd., for 20 top covers to tramcars.

Johannesburg.—The Council has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for truck and electrical equipment for 10 double-decked bogie cars, to specification, at £513 10s. per car.

Liverpool.—The tender of the Palatine Engineering Co., Ltd., has been accepted by the Corporation for an electrical transmitter and recorder in connection with the installation of electrical communication between Woolton Hill Reservoir and Dudlow Lane pumping station.

London.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, have obtained a further contract for the supply of 20,000 tantalum traction lamps to the L.C.C. for use on its tramcars.

Maidenhead.—The T.C. has accepted the tender of the Klein Engineering Co. for the repair and partial reconstruction of the cooling tower at the E.L. works, at £64.

Maidstone.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for a motor-generator, at £373.

Morley.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for a 12-H.P. motor to replace a gas engine at the highway depôt.

Newcastle-under-Lyme.—The T.C. has accepted the tender of Messrs. J. Bagguley & Son, of Newcastle, for the supply and laying of mains in Liverpool Road, at £760.

Portsmouth.—The E.L. Committee of the T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for Insdale screened nuts, at 16s. 4d. per ton, with an option on Insdale small, at 14s. 10d. per ton. The price shows an increase of about 3s. per ton; this will cost the undertaking £1,500 extra.

Rugby.—The Hospital Board of Management has accepted the tender of Mr. S. P. Marsh, of Rugby, for wiring Brookfield for the E.L. and bells, at £35.

Stafford.—The T.C. has accepted the tender of Mr. John Thompson, of Wolverhampton, for a superheater for a new boiler at the electricity works, at £70.

Stoke-on-Trent.—The T.C. has accepted tenders for coal for the electricity works, as under :—

Sneyd Collieries, Ltd., cockshead slack.
Shelton Iron, Steel and Coal Co., great row slack.
Florence Coal and Iron Co., washed slack.
Mossfield Colliery Co., Ltd., slack.

Stockport.—The Tramways Committee has ordered three railless cars, costing £682 each, from the Brush Electrical Engineering Co., Ltd., to serve a hilly and narrow route wholly within the county borough.

The Electricity Committee has placed with Messrs. Belliss and Morcom, Ltd., an order for a 1,500-kw. mixed-pressure turbo-alternator, and a 500-kw. engine set.

Tunbridge Wells.—The T.C. has accepted the tender of the Western Electric Co., Ltd., for cables.

For coal for the E.L. works, the following tenders have been accepted :—

Wm. Cory & Son, Ltd., Bwlfa, £1 5s. 5d. per ton.
Harris, Hardman & Co., Ltd., washed Scotch peas, 17s. 8d. per ton.
Medway Coal Co., South Hetton, rough small, 18s. 2d. per ton.

Wimbledon.—The T.C. has accepted the tender of Wm. H. Gaze & Sons, Ltd., at £97, for installing an intercommunicating telephone system at the Isolation Hospital; also to maintain the system for a period of three years from the end of the first year after completion for £7 19s. per annum. The tender of A. How and Co., has also been accepted, at £54, for wiring the administrative block extension at the Isolation Hospital.

Warrington.—The B.G. has accepted the tender of Mr. H. Bibby, of Warrington, for electric equipments at the workhouse kitchen, at £90.

Watford.—The U.D.C. has accepted the tender of the Union Electric Co., at £260, for the supply of a motor-generator.

West Ham.—For an electric light installation at the Forest Gate Sick Home, 95, Forest Lane, E., for the Guardians of the West Ham Union, the following tenders were submitted. Architect: Mr. J. Williams Dunford, 100c, Queen Victoria Street, E.C. :—

Foote & Milne	£2,304	Weston & Sons	£1,301
Waring & Withers	2,043	H. J. Godfrey	1,298
Ryan & Son	1,958	Hammond & Co.	1,276
Newbald & Son	1,849	B. A. Pilkington (Edinburgh)	1,274
Duncan Watson & Co.	1,750	H. J. Whitehead	1,259
West Ham Corporation	1,730	Williams & Bach	1,250
Polden & Co.	1,645	Hancock & Rixon	1,249
Lund Bros. & Co.	1,615	Arthur Newton	1,215
J. C. Christie	1,598	Tilley Bros.	1,197
Saville & Walton	1,595	Holmes & Sons	1,180
Durell Walker & Co.	1,498	J. T. Halsey	1,146
Cathcart & Co.	1,475	Herring & Son	1,090
Pinching & Walton	1,425	Tredegars	1,085
Malcolm & Allan	1,400	**W. R. Reynolds, Ltd.** (accepted)	993
Cash & Co.	1,359	Mechanical and Electrical Engineering Co. (Walsall)	987
New Century Arc Light Co.	1,307		
Fryer & Co.	1,303		
Architect's estimate	£1,270		

AUSTRALIAN TRADE.

By this mail from Australia we have received a full report of the instructions issued by the Premier of Victoria to the various contracting departments, establishing the principle of facilities to be given to British firms in competition with foreign. These instructions lay down that a preference is to be given to British tenders; that sufficient time for tendering is to be given to allow of mail service from and to Australia, and of adequate time to prepare tenders in England, and that inspection of deliveries is to be effected in England and not in Australia, as formerly. We shall have occasion next week to refer to this matter in greater detail. In the meantime, we desire to record our appreciation of the attitude now taken up, which, if rightly understood, means a tremendous impetus to British trade. We hear from Australia that this attitude is the result of the valuable work carried on in Australia by our own Trade Commissioner—Mr. Hamilton Wickes—to whose activities we have previously been pleased to call attention. Mr. Wickes, we understand, is now in England on his way to a new post in Canada; and while congratulating him on his new appointment, we cannot but regret that he is leaving Australia just at a time when this important success has been achieved. Agents in Australia of large British firms are anxiously anticipating the appointment of the new representative of the Government, and are hoping that he will be able to gain the confidence of the Australians as Mr. Wickes has done.

Post Office Factories.—In the Parliamentary questions Mr. Nannetti asked the Postmaster-General if he would state what was the total force at present employed in Post Office and telephone factories and mechanics' workshops in Great Britain and Ireland, respectively; and what would be the estimated numbers when the recommendations of the Factories Committee had been carried into effect. Mr. H. Samuel replied that the figures were 1,465 in Great Britain and 12 in Ireland. It was not yet practicable to furnish an estimate of the numbers as they would be when the recommendations of the Factories Committee had been carried out.

NOTES.

A Motor Trouble.—The reliability and usefulness of electric power have compelled recognition at the hands of owners of industrial plants, and a great many of these have adopted electricity as the motive power for their works; but it cannot be too strongly emphasised that it is not sufficient simply to plant a motor in any convenient position and run a few indiscriminate wires to it. Care should not only be taken in the lay-out of the plant to be driven and in the installation of the motors themselves, but adequate means should be taken to see that the cables connecting the motors to the power supply are arranged in a systematic and workmanlike manner; otherwise, trouble is sure to occur. This may be exemplified by an incident which caused a good deal of mental friction to the owner of an industrial undertaking which was driven by several motors of the shunt-wound type. The behaviour of one of his motors was somewhat puzzling. When it was first started up, this motor would run quite smoothly until some load was put on the machine which it was driving. Within 10 minutes after this had been done, and sometimes less, the motor would start racing, frequently getting up an enormous speed before the attendant could get to the starting switch and trip the motor out of circuit. When the armature was felt, it was found to be extremely hot after this performance. Eventually the motor was overhauled, and it was found that the shunt wire, which was only a small, insignificant-looking affair, had been brought into the motor at a sharp bend and, owing to subsequent strain on it, due to bad arrangement of wiring circuits, the end of the wire had pulled out slightly from underneath the screw in the motor-terminal. Contact was still maintained, but it was only very slight. What happened, therefore, was that the wire would make contact sufficiently to allow the motor to be started up, but directly some load came on the machine and vibration was set up, the end of the lead would start shaking and causing small arcs. In other words, the field windings would be intermittently magnetised, and as the machine was shunt-wound, there would be short, spasmodic rushes of heavy current through the armature every time the field failed, and the speed gain would be enormous, while the heating effect of such rushes of current would be excessive. The matter was, of course, remedied by making the lay-out of the wiring a little different, so that the sharp bend and straining action were done away with, after which the motor ran quite well without any further trouble.

Educational Note.—We have received the programme of the Ducal Technical High School of Brunswick for the year 1912-13, which commences on October 22nd. It includes courses in engineering, of which some particulars are given; Prof. Dr. W. Peukert is at the head of the electrotechnical department.

Appointments Vacant.—Resident electrical engineer, for the Tunbridge Wells Corporation (£300); works superintendent, for the Whitehaven electricity works (£2 2s.); assistant engineer, for the burgh electricity department, Paisley (£182); log-book keeper and voltage regulator, for the Stepney B.C. (25s.). See our advertisement pages to-day.

Indentured Apprentices and Electrical Pursuits.—It appears from the annual report of the National Institution of Apprenticeship that under the auspices and influence of that organisation 1,230 apprentices are now indentured to masters in different trades. Of that number, 12 are serving their time as electrical fittings makers, nine as electrical instrument makers, and 67 as electrical engineers, whilst 58 are learning to be general engineers. The report states that during the year 2,682 applicants were interviewed, but that, as in previous years, a large number of parents withdrew their applications upon learning that the wages paid to apprentices during the first year or two were substantially lower than those paid to errand boys and the like, which disadvantage, added to the cost of the fares to and from the workshop, entailed a sacrifice they could not afford to make.

Fires on Tramcars.—A considerable amount of attention has been paid in recent times by traction engineers to the question of fireproof construction of rolling stock, more particularly as regards electric trains, and this is a very wise precaution, inasmuch as the slightest indication of a fire, or even the smell of burning in an electrical conveyance of this nature, is liable to cause a panic among the passengers which may lead to very disastrous consequences. Even in the smaller transport units which are usual in the ordinary town electric tramway systems, it is highly desirable that every precaution should be taken to see that risk of fire is avoided as far as possible, inasmuch as should an electrical fire break out in a crowded tramcar, there is every probability that a rush would be made for the doors, and people would injure themselves in trying to drop off the car when it was running at a fairly high speed. Fortunately instances of fires on tramcars are comparatively rare, and when they do happen they can usually be traced to some simple cause which can be easily rectified. Modern design has largely eliminated the fire risk from tramcar construction, and in those isolated cases where instances of this nature have happened, the cause could hardly have been foreseen. In order to illustrate this, it may be interesting to refer to two typical examples of the class of trouble which may lead to fire, or at any rate to charring, in order that so far as possible these danger symptoms may be eliminated, not only on account of the potential danger, but also of the bad impression any untoward incident of this nature leaves upon the minds of the general public. In one case while a car was in service it was noticed by passers-by that the car was smoking very badly, the origin of the smoke appearing to be situated underneath the car. The attention of the driver was drawn by the fact that his circuit-breaker opened rapidly and repeatedly, and he came to the conclusion that there was trouble in the electrical equipment of the car, which was confirmed when he saw the smoke. On looking round, however, everything appeared to be all right, but in order to make sure of this the pole was removed from the line. After inspecting the car it was discovered that the smoke was proceeding from the lightning arrester which was placed under the car, and then the cause of the trouble was discovered. Owing to the wet weather and to dirt getting into the box, a short-circuit had occurred, and small arcing had been going on for some time. The heat of this arcing had gradually caused the wood box in which the arrester was placed to char, and eventually opened the circuit-breaker. The car was run home to the depôt, and in order to repair the matter the cable was taken off and dried, and when a new box was fitted the woodwork was painted with lead paint in order to render it impervious to moisture. With these precautions no further trouble was experienced from this cause. In another instance the trouble was, perhaps, a little more spectacular, although no actual danger to passengers was caused. In this case the cable burnt out, which was behind the door inside the car. The cable concerned was the trolley cable brought from the roof to the circuit-breaker, and then down a body pillar on the inside of the car to the controller. This cable was cleated to the body pillar, but it was not quite clear of the roller on which the door ran, and every time the door was opened it fouled the cable. The insulation of the cable was therefore destroyed and the cable earthed through the door-wheel to the iron floor tread, with brilliant results. In order to repair this defect it did not take much trouble to renew the insulation of the cable, and the body pillar was recessed enough to allow the cable to be carried clear of the door. This incident is mentioned here in order to show that a very slight oversight, such as described, can easily cause a certain amount of insecurity to the passengers travelling in the car. The point of the above incidents is, that although the actual danger incurred was so slight as to be insignificant, the occurrences were undesirable on account of the feeling of alarm which might easily have been created in the minds of passengers, and therefore it is worth attention on the part of tramway engineers to see that the electrical equipment on a tramcar is maintained in a thoroughly fireproof condition.

Street-Box Covers.—Inspection-box covers laid in the pavement, when filled with broken brick concrete of proportions of 1 : 2 : 5 are apt to wear unevenly, as the filling is of a softer nature than the surrounding pavement. This is overcome by surfacing the cover with a layer of granolithic concrete, ¾ in. thick, laid on the top of the concrete filling while the latter is green.

A surfacing mixture which has good wearing qualities consists of fine granite, no particle being larger than will pass a ⅛-in. ring; take one part cement and three parts granite, including the dust, which dispenses with the addition of any sand; mix rather dry and trowel a hard surface. The setting of the cement greatly affects the wearing qualities; covers filled in and allowed to dry in the atmosphere turn to a powdery nature, due to the contraction of the cement liberating small particles of granite, which tend to grind the surface in wear. When allowed to set rapidly in a warm atmosphere, the cohesion of the cement is secured by contraction and produces a crumbling mass, as though made of poor cement.

Cement set under water expands and produces a harder concrete by the cohesion of the cement on the individual particles of granite dust. With large or heavy covers not easily handled, a hardening process should be applied by covering the surfaces for at least two weeks with bags or common sheeting kept moist with water. The effect of this method in summer is better than total immersion, as evaporation reduces the temperature of the surface of the concrete, and retards the setting of the cement sufficiently to produce hardness. To further the hardening, a wash of equal parts of water and silicate of soda may be applied.

Cover tops are sometimes cambered and stand above the surface of the pavement. The raised surface is not observable by the average pedestrian, who makes no change in his step in passing over, so that the camber comes in contact with the foot before a man has completed his step; this rubbing action by every footstep is an important consideration affecting the wearing away of the surfacing of the cover.

To increase the durability some resisting material should be worked into the surfacing. This can be effected by mixing steel lathe turnings in with the granite. They should be broken up small and be free from grease.

It is advisable to make the surface non-slipping by serrating or chequering the surface. If lead rings cut from a ¾-in.-1-in. diam. lead pipe are imbedded in the granolithic they will provide a good non-slipping surface: should the box be situate on an incline, more effective non-slipping may be produced by inserting ¾-in. square plugs of carborundum, which gives a positive hold to the foot, wet or dry.

For Sale.—The Newport Corporation electricity and tramways department has for disposal a quantity of scrap copper, brass, &c. See our advertisement pages to-day.

Electricity and Hygiene.—At the Health Exhibition held in connection with the Congress of the Royal Sanitary Institute last week, a silver medal was awarded to the City of York Electric Lighting Department for the hygienic value of its exhibit of electrical appliances; an additional silver medal was also awarded to the department for the "Tricity" electric cooker.

(*Continued on page* 224.)

DEPTFORD GENERATING STATION OF THE LONDON ELECTRIC SUPPLY CORPORATION, Ltd.

It was with particular pleasure that we accepted the invitation of Mr. G. W. Partridge, chief engineer to the Corporation, again to revisit this, the pioneer high-pressure electric generating station of the world, at a moment when the man whose genius gave it birth occupied the chair of President of the Institution of Electrical Engineers. In that capacity, Mr. de Ferranti during the past two years has recalled to mind many interesting reminiscences of those stirring times when they did things, and each day gave rise to new and unexpected (often, indeed, undesired) discoveries. It was in 1887 that, owing to the increasing demand, the London Electric Supply Corporation was formed with a capital of £1,000,000, and decided to build a large generating station at Deptford, where an unlimited water supply could be obtained for condensing purposes and cheap sea-borne coal procured at low prices, with ample space for extensions. The whole scheme at that time was severely criticised by leading engineers in all parts of the world, but in spite of the uphill work which such an enterprise necessitated, including the expenditure of enormous sums of money on experimental work, the 10,000-volt extra-high-pressure system was finally made a success, and has since been adopted by engineers all over the world. It is interesting at this time to reproduce a print of the old Grosvenor Gallery dynamos, which were at that time the largest generators in use in this country. Two 1,500-H.P. 10,000-volt machines were manufactured and erected in 1889, and the engines, which were made by Messrs. Hick Hargreaves, are to-day running on load and giving very economical results. These machines were by far the largest in the world at the time, but still larger steam alternators of 10,000 H.P. were actually put in hand shortly afterwards. We illustrate one of these sets on p. 223, and, as the new turbines have also a similar capacity of 10,000 H.P., they are shown for comparative purposes alongside the original 10,000-H.P. generators. The shafts of these giants were 36 in. in diameter, and the armatures about 46 ft. in diameter; the speed was 60 R.P.M.; and the weight of the alternator, exclusive of the engine, about 500 tons. The site was laid out for a final capacity of 120,000 H.P. The whole of this work was designed by Mr. S. Z. de Ferranti, and although

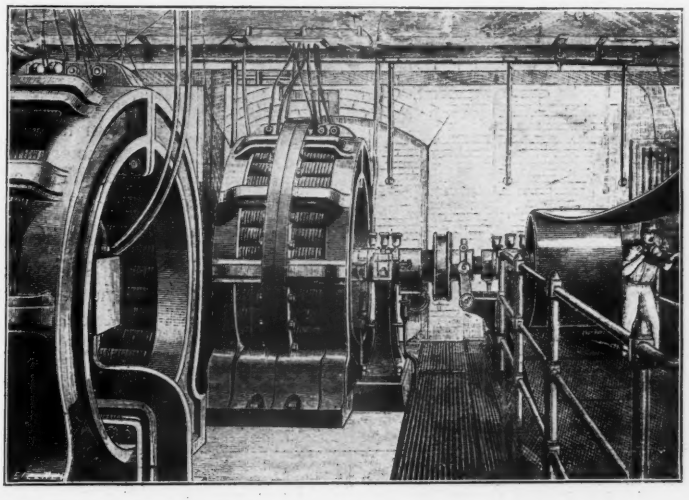


Fig. 1.—Old Alternators at the Grosvenor Station.

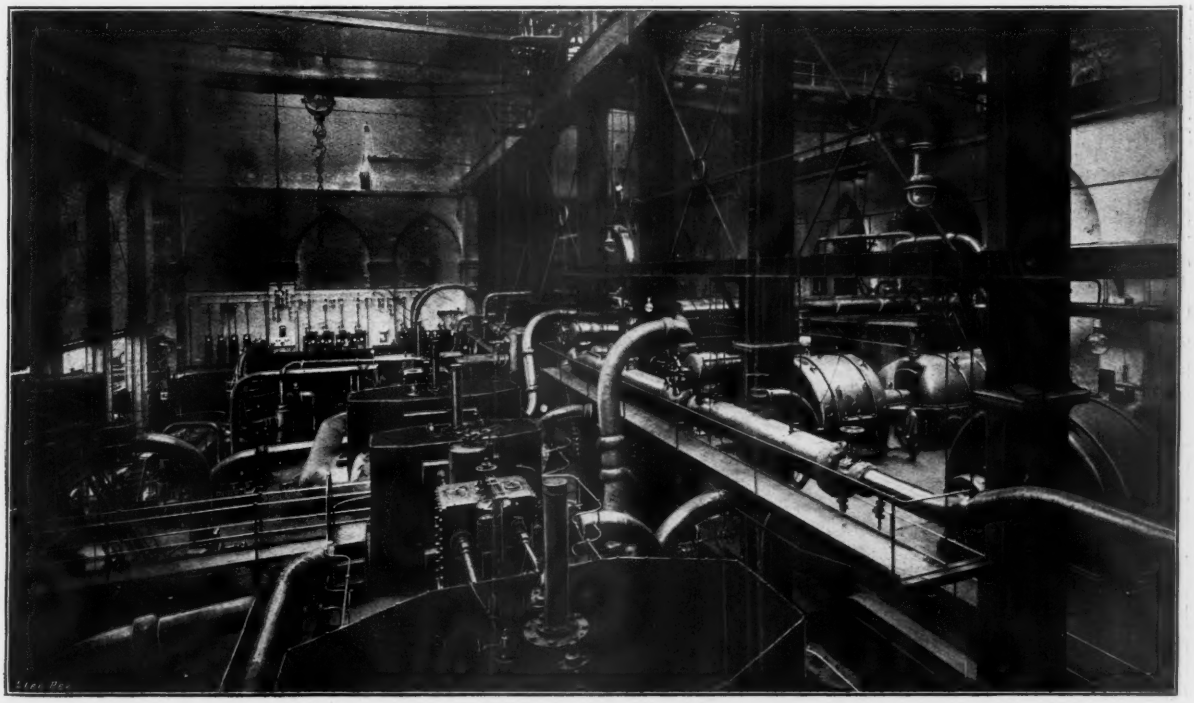


Fig. 2.—General View of the Engine-room at the Deptford Works.

these large generators were never put into actual work, one cannot but admire the boldness and ingenuity of the designer.

Numerous breakdowns and difficulties occurred in transmitting current at a pressure of 10,000 volts from Deptford to London, and the London Electric Supply Corporation was obliged to manufacture its own cables, designed by Mr. Ferranti, and made up of an inner and outer copper tube forming the two conductors, arranged concentrically with each other, and separated by a radial thickness of $\frac{1}{2}$ in. of paper insulation, each conductor having a sectional area of 0·25 sq. in. The insulation used consisted throughout of paper impregnated under pressure with "ozokerite" wax. About 28 miles of it in all were laid down, which for years ran satisfactorily, at a pressure of 10,000 volts, in spite of the numerous joints (over 7,000 in all). Considerable lengths of this main are still in use at the present time, running satisfactorily at a pressure of 10,000 volts. This cable was the pioneer of all high-pressure paper-insulated cables in the world.

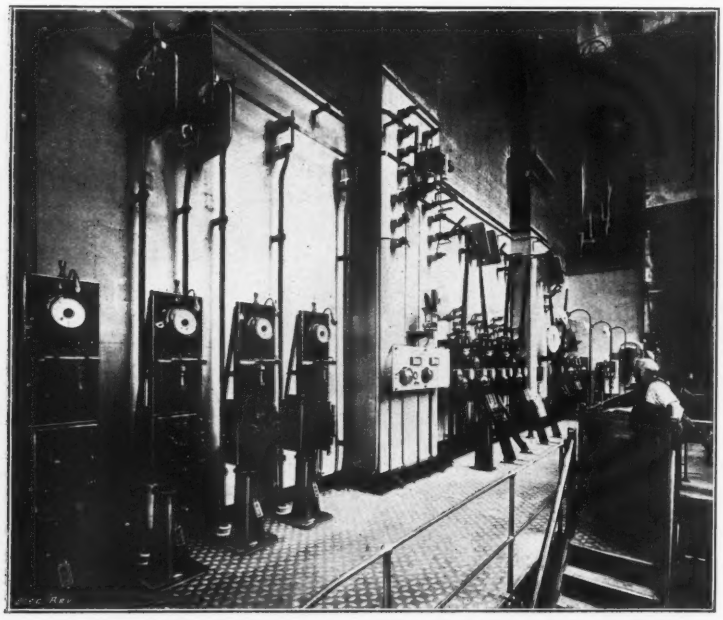


Fig. 3.—Original 10,000-Volt Single-Phase Switchboard (in use for 17 Years).

This station is now giving four distinct supplies to its different customers in various parts of its area. They may be described as follows :—

1. The original 85-cycle 10,000-volt single-phase system used for lighting purposes.

2. Direct-current three-wire 460 and 230 volts, used for power and lighting purposes.

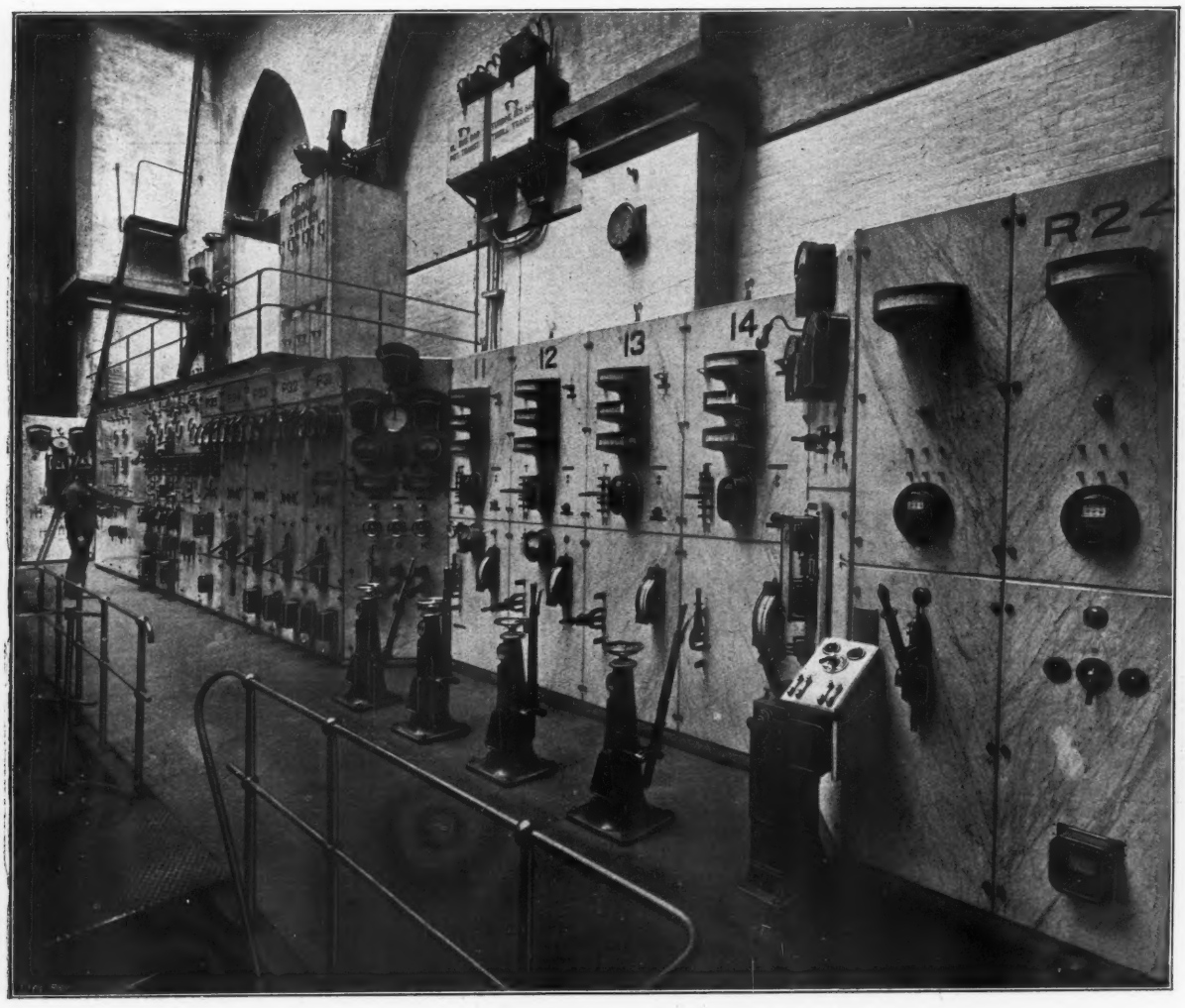


Fig. 4.—New Traction and Power Switchboard.

3. Three-phase 25-cycle 6,600-volt, for large power consumers or traction purposes.

4. The single-phase 6,600-volt 25-cycle system used for the Brighton Railway.

One of our views, which is taken from the top of the traction board, gives a general view of the station, the engines in front being the 2,500-kw. reciprocating sets,

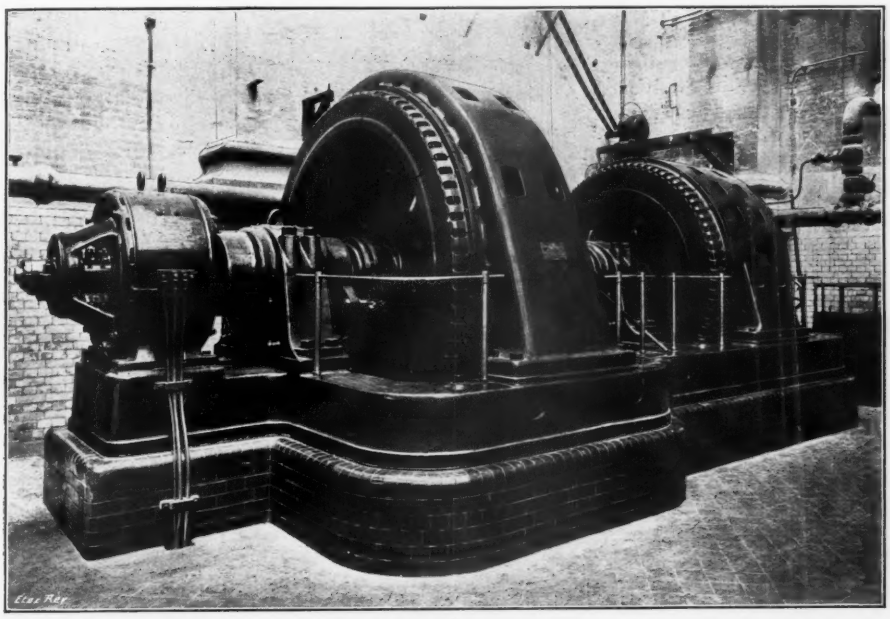


Fig. 5.—Westinghouse 2,000-h.p. Motor-Generator.

which were in the first place used for supplying energy to the tramway system of the London County Council, and later for the supply to the first of the electrified sections of the Brighton Railway. These generators are three-phase star-wound machines, so arranged as to be able to give either a single or three-phase supply. They are now being used in conjunction with two 10,000-h.p. turbines which have recently been installed and are shown on the right-hand side of the illustration.

The station is divided, generally speaking, into two sections, one for railway traction and power supply, the other for lighting purposes. The lighting plant consists of Ferranti and British Thomson-Houston 10,000-volt 85-cycle single-phase machines. We illustrate the original 10,000-volt 85-cycle switchboard, the machine switches of which have been in actual use for 17 years. These switches have an air-break of 4 ft. 6 in., and have never given any trouble since they were first installed. No automatic control is used on the generators, the switches being worked by mechanical remote control, the first instance of this type at that time in the country.

It is interesting to note that a special 10,000-volt oil switch was designed to work in conjunction with these air-break switches at that early period (1895), but as the air-break switches put out the arc satisfactorily the oil switch was not used on this particular switchboard, although oil switches had been in actual use on the company's circuits working at a pressure of 2,500 volts since the year 1892; these were the first oil switches ever used in commercial practice.

The switches in the foreground of the illustration are modern oil switches controlling the 10,000-volt trunk mains. Each of these switch panels is provided with a special charging switch used for preventing the rise in pressure when trunk mains are switched on or off. Owing to the early troubles experienced when these 10,000-volt mains were first used, a mains-charging apparatus was first designed in 1894 and has been in daily use ever since. The whole of this early type of switchgear, including the original oil switch, was designed by Mr. G. W. Partridge, the present chief engineer of the company.

A very interesting motor-generator set, manufactured by the British Westinghouse Co., and shown in the adjoining view, has recently been installed, having a capacity of 2,000 h.p. The motor of this set is driven from the three-phase 25-cycle system on the traction side, and drives a generator giving single-phase 10,000-volt 85-cycle current. By this means both sides of the generating station can be connected together when required, and the large turbines used at their maximum efficiency and capacity. This set, besides being used at times of light load, is also used at times of peak load in the lighting section with the rest of the lighting generators in parallel with it, and although the motor-generator alone is fitted with a Tirrill regulator, this one set enables the pressure of the whole of the lighting section to be kept absolutely constant, all irregularities being apparently taken care of by the motor-generator. The set is made specially strong, so as to resist any mechanical shocks due to short circuits or bad synchronising taking place on either section of the gene-

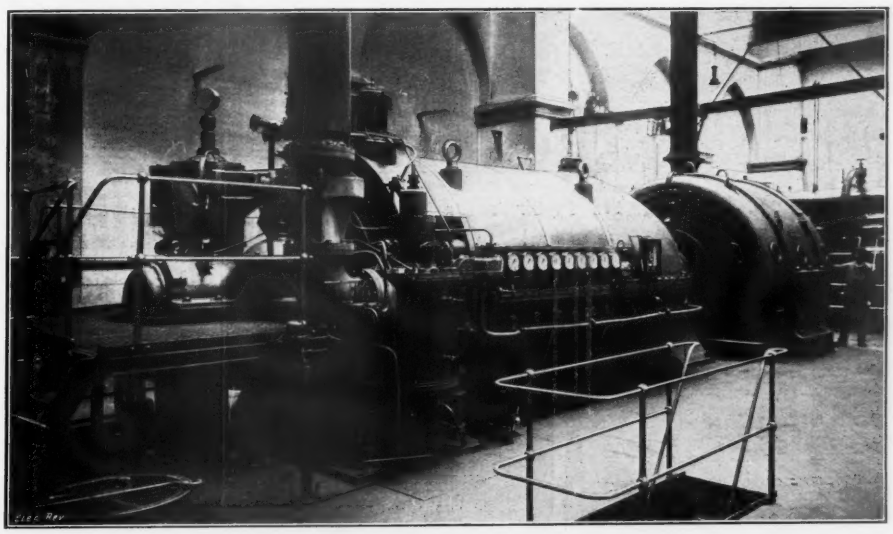


Fig. 6.—Steam End of Parsons-Brown, Boveri 10,000-h.p. Turbo-Alternator.

rating station. The Deptford generating station ran regularly in parallel with the London County Council station for some years, and it was demonstrated that the chief difficulties, such as induction, &c., were overcome by having a 25-cycle instead of a 50-cycle system.

The six single-phase 10,000-volt lighting sets have already been described in earlier years. The modern side of the station has recently been completed. One of our illustrations shows the traction switchboard from the front. This board controls four 2,500-KW. reciprocating sets and also the two 7,500-KW. three-phase turbo-generators. The switchboard controlling the four reciprocating sets is divided into three galleries, while the turbine switchboard at the further end is divided into four galleries. From this board run four traction single-phase feeders for the railway service, and five three-phase feeders for power supply to various factories in the Corporation's South London area. The section controlling the reciprocating sets is laid out with bare copper bus-bars and connections in stone cell-work in a similar manner to other high-tension boards in this country, but has this special feature—that the generator connections are provided with throw-over switches so that any machine may be connected to either the three-phase or the single-phase traction supply, automatic pilot lamps on the control board showing the attendant which system the generators are running on or available for.

Owing to the difficulties which have been experienced on this type of board, due to cleaning live conductors, Home Office requirements, &c., it was thought desirable to go one better in the recent additions for controlling the two turbines and new feeders. This new section is divided into four galleries, the oil switches and group switches controlling the turbines being placed on the top gallery, whilst the oil switches controlling the feeders are placed in the lowest gallery.

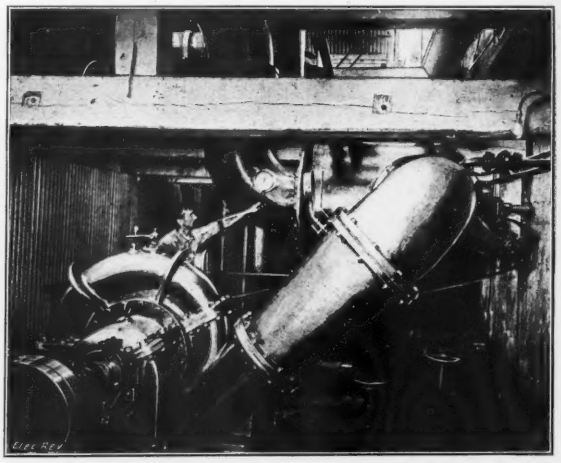


FIG. 7.—ROTARY STRAINER.

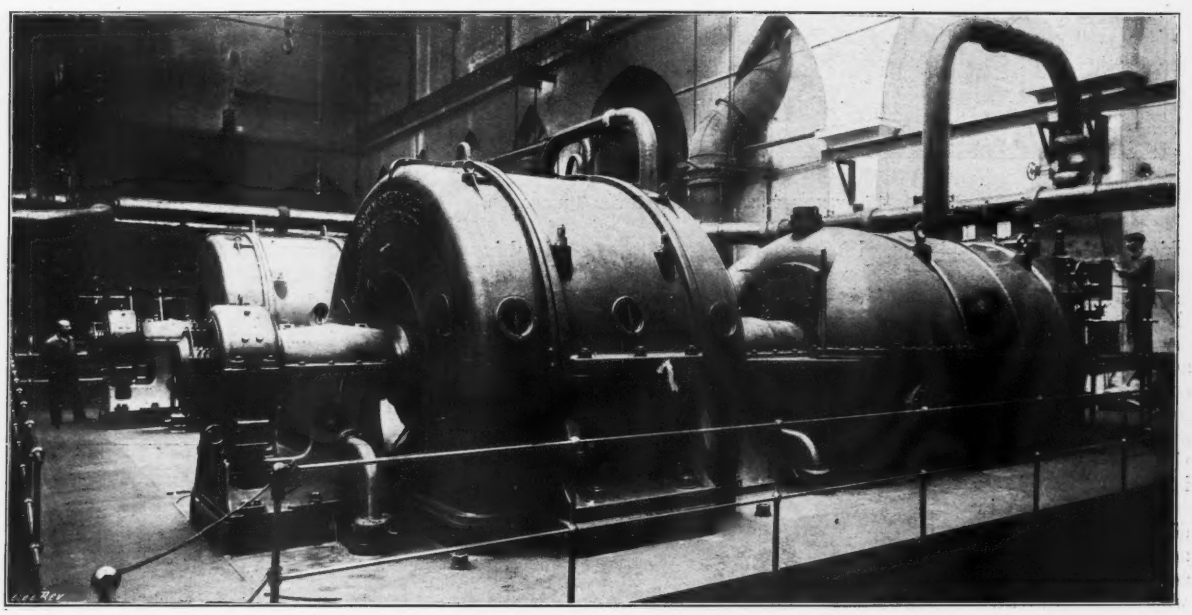


FIG. 8.—GENERATOR END OF 10,000-H.P. TURBO-ALTERNATORS.

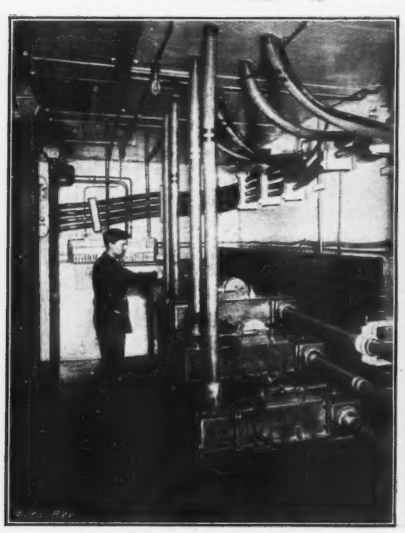
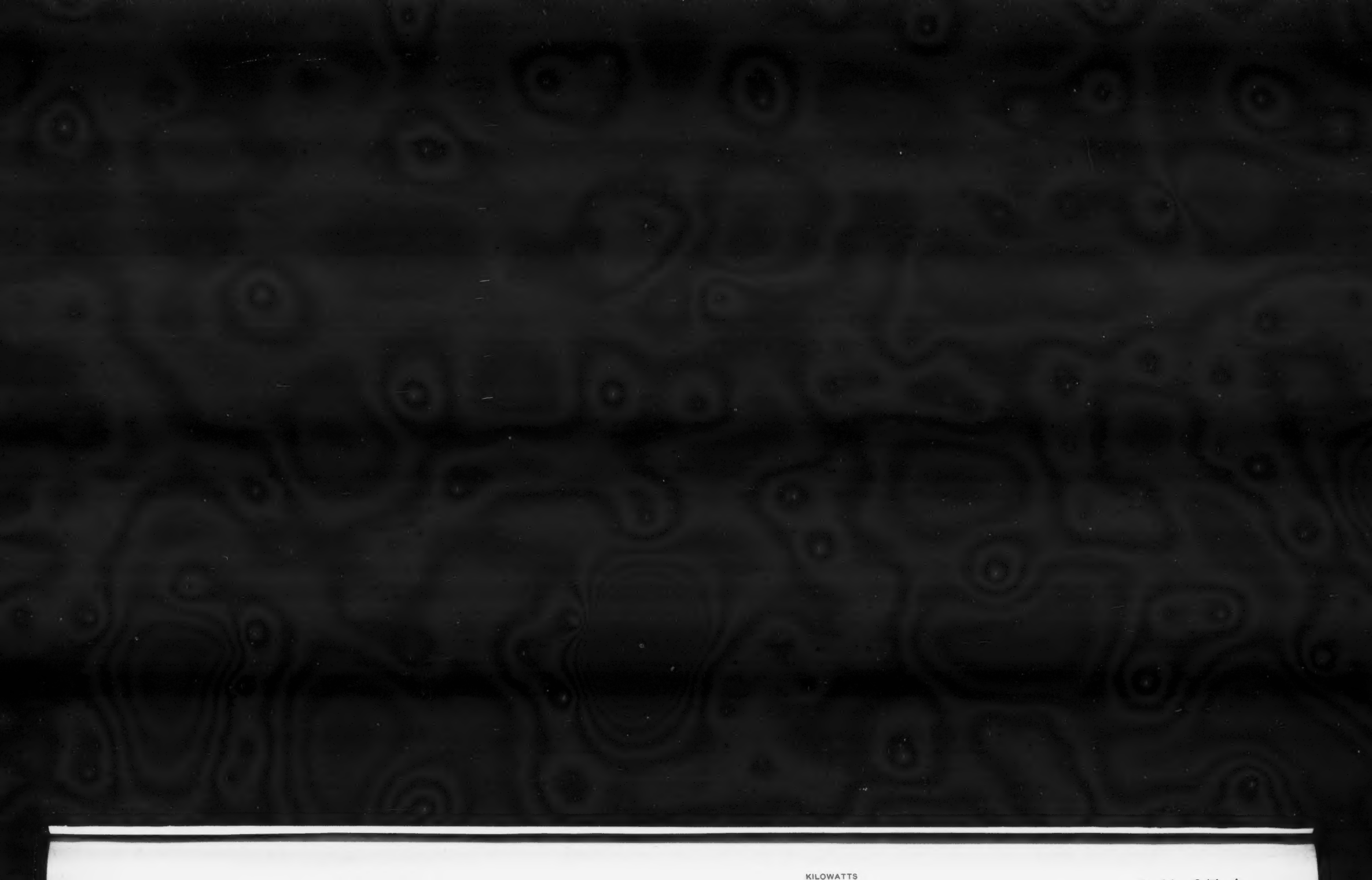


FIG. 9.—BACK OF TRACTION SWITCHBOARD. FIG. 10.—REACTANCE COIL FOR 10,000 AMPS.

The whole of the high-pressure conductors are laid out in such a manner that each conductor and isolating switch is enclosed in an earthed shield. The advantages claimed for this system are as follows :—

1. It does not require cleaning.
2. Live conductors cannot be touched or short-circuits caused by rats or other live animals.
3. Any arc that may be set up is not liable to short-circuit all three phases.
4. The series transformers, a weak point in all other systems, and the cause of many serious breakdowns, are clamped outside the earthed covering, thereby making a failure in this part of the system almost impossible.
5. Heavy short-circuits, which before now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have broken insulators due to the repulsion between conductors, can in no way affect this system.

6. Isolating switches are locked in the "on" and "off" positions.

Another view shows the back of the traction board. Several special interlocking devices are used with this particular system. For example, it is impossible for an attendant to get at the key of the isolating switches without opening the oil switch of the main generator, thus automatically preventing the isolating switches from being opened under current. By means of pilot lamps the attendant on the control board can see the exact position of the isolating switches. The lamps in question will only indicate if all three phases are in the "on" or "off" position. Many other advantages are claimed for this system.

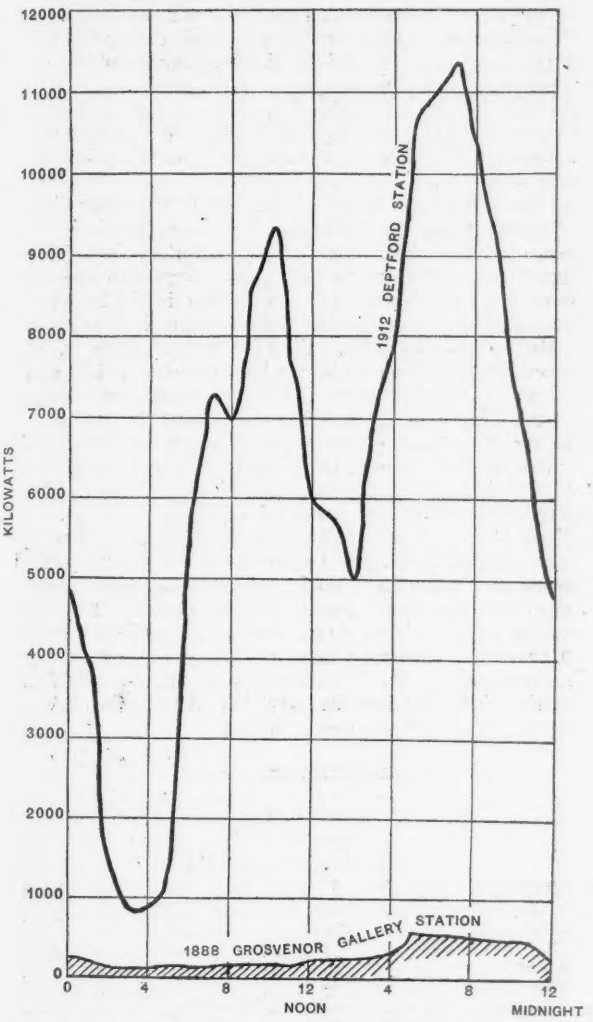


Fig 11.—Load Curves: Grosvenor Gallery, 1888 and Deptford, 1912

The generator and group switches are of especially large type, motor driven, and are capable of carrying a current of 2,000 amperes and breaking at the moment of short circuit 40,000 amperes. These switches have been actually tested by switching one of the large 10,000-h.p. generators on to a short circuit and switching it off again.

Owing to the enormous currents given by turbo-generators on short circuit it was thought advisable to install reactance coils, so as to reduce the current as much as possible and prevent undue stress on the windings of the generators, &c. One of our illustrations shows a reactance coil used in connection with the railway supply. This coil, which has a reactance of about 4 per cent., is designed to withstand a short-circuit current of 10,000 amperes. The weight of the coil is about 15 tons.

We give two views of the two 10,000-h.p. turbo-generators. The turbines, which are of the impulse-reaction type, were made by Messrs. C. A. Parsons & Co. The impulse blades are fixed in the grooves of the velocity wheel by two layers of caulking pieces, each independently caulked so as to get the strongest possible mechanical fixture. The intermediate and low-pressure ends of the turbine are of the usual standard reaction blading, built up on segments beforehand on the Parsons rosary threaded root system. There are three groups of nozzles on these turbines, each group controlled by a special design of automatic valve, which by opening brings the group of nozzles into operation as soon as the preceding group is utilised to its full capacity. The use of these automatic valves enables the lowest possible steam consumption to be obtained at all variations of load. There is a fourth group of nozzles controlled by hand, which can be used to deal with overloads if it becomes necessary.

The well-known Parsons type of steam relay governor controls the speed of the turbines, which have a variation of not more than 3 per cent., notwithstanding the rapid changes of load which take place when the machines are on the railway service.

The electric generators were manufactured by Messrs. Brown, Boveri & Co., and are the largest hitherto constructed in this country. These generators are specially designed to operate under the very special conditions which prevail on the traction system. This particular type of construction was adopted by the Corporation principally on account of its mechanical strength, in view of the heavy overloads with which the machines will have to deal. The generators are specially arranged so as to give either a single-phase or a three-phase supply. The capacity of each of these machines is 7,500 kw. normal rating, when running three-phase, with an overload of 50 per cent. for half an hour. They are at present dealing with loads up to 7,500 kw. when running as single-phase machines. The generators are arranged for self-contained induced draught; the cool air enters the machine from below, passes through the various parts, and then, through a special duct running through the engine

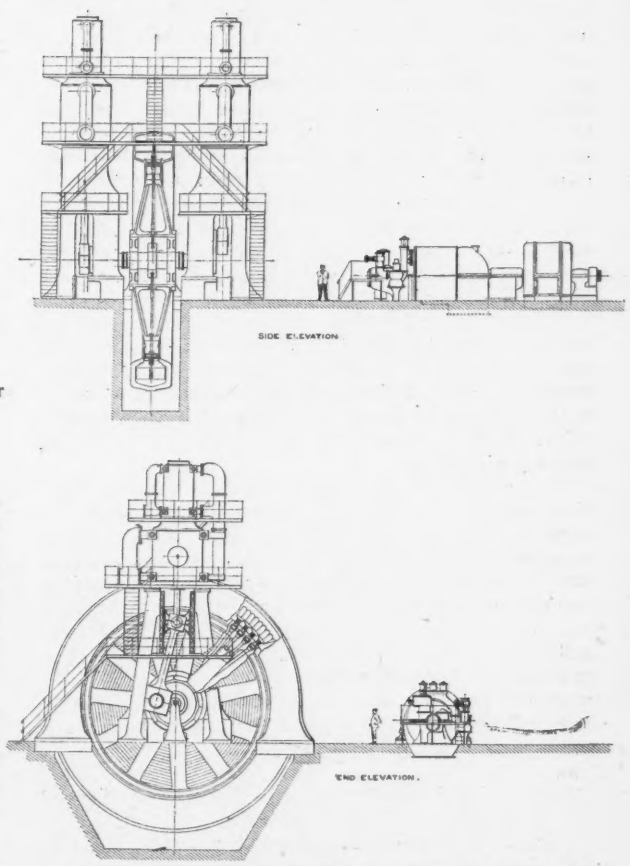


Fig. 12.—Comparison between the 10,000-h.p. Steam Alternators of the London Electric Supply Corporation, 1889 and 1912.

room, is discharged outside the building. Two special air filters are provided for each machine, capable of dealing with 27,000 cb. ft. of air per minute. The pole shoes of the rotors are provided with heavy copper damping windings to reduce the pulsating field set up when they are giving a single-phase supply. Mica is used throughout for the insulation of the armature, the end connections of the windings being specially secured, not only at the end of the coil, but where each bar leaves the slot.

The voltage regulation of these large generators is entirely controlled by an automatic Tirrill regulator, which, considering the variations of power factor, load, &c., which take place, gives wonderful results.

The boiler house contains 22 Babcock & Wilcox boilers and 10 Paxman boilers, with complete superheater and economiser equipment. Two new Babcock & Wilcox boilers, each having a capacity of 25,000 lb. of steam per hour, are now being installed, making a total capacity of boiler plant of 760,000 lb. of steam per hour. There is ample capacity on the wharf for further extensions of boilers and generating plant, and also for large quantities of coal, so that the generating station may be regarded as practically independent of coal strikes, &c.

The water for condensing purposes is taken from the River Thames, and the method of straining the water is of special interest, as an entirely new form of strainer (shown in one of our views) has been designed for the purpose. Two of these strainers are at present in use in Deptford. The chief points of interest in this type of strainer are its first cost—which is about one-third of that of other self-cleaning strainers on the market—its low cost of upkeep and power required to operate, and the small space occupied.

The strainer proper is in the form of a drum, the surface of which is perforated with a large number of holes. The drum, which is contained in a closed cast-iron housing, rotates at a speed of 3 to 5 R.P.M. by means of a reduction gear driven from the centrifugal pump shaft. The water entering the housing passes through the perforations into the interior of the drum, and thence into the pipe system to the condensers. Any *débris* carried in by the water adheres to the outside of the drum until it reaches a scraper, so placed as to act on the lower surface of the strainer. This scraper has a shaving action on the drum, and causes any *débris* adhering to the perforated surface to fall into a settling chamber formed in the bottom of the strainer body, quite outside the flow of water. The *débris* can be discharged to the river by opening either automatically or by hand a sludge valve, which is connected to the return pipe from the condensers. These strainers have been dealing with the full quantity of water required by the generating station for the last two years, and have been giving every satisfaction. Both strainers were made by the Corporation in their own workshops.

The coal supplies are all obtained from the river, coal being delivered alongside the Corporation's frontages in barges of 200 tons and upwards. For unloading these barges special grab cranes are provided, by which the coal is worked out into a weighing hopper, whence it gravitates into large skips; these are picked up by a Temperley transporter, which conveys the coal over the boiler house, depositing it on the coal floors or in the bunkers. Ample storage facilities are available not only over the boiler house, but also on the wharf, and previously to the recent coal strike sufficient coal for several months' supply was stored on the premises, which quantity could be very largely increased should the necessity arise.

As it was by virtue of necessity in the early experimental days, so in later times it has been the policy of the Deptford works to be as far as possible independent of all outside contractors, not only for their repairs but also largely as regards new material for extensions. In addition to the workshops which have been previously referred to, the station is provided with a large drawing office and staff, where some of the main engines, including one of 2,000 I.H.P., and other important parts of the plant have either been designed originally or redesigned, the construction or reconstruction, as the case may be, being subsequently largely carried out in the Corporation's workshops. These shops are well equipped with machine tools, which are capable of handling the largest parts of the generating plant for repair purposes. When not engaged on repairs the shops are kept going on new work. In addition to strainers and other parts in connection with the condensing plant, a large number of the valves required for recent extensions, from high-pressure steam valves up to 48-in. diameter exhaust valves, have been made in the Corporation's shops. It will be readily understood that the advantage of having such great facilities for works of construction and repair on the premises cannot be over-estimated.

The immense progress that has been made during the last 24 years is well illustrated by the load curves which we reproduce on the previous page. It is interesting, too, to note that in our issue of May 8th, 1891, we gave a number of views of the original Deptford plant, including the huge 10,000-H.P. alternator then in course of construction but never completed.

There can be, we should think, few, if any, other electricity supply undertakings in this or any country which can boast of a more loyal and devoted staff than the London Electric Supply Corporation has the good fortune to possess; several of its members have been employed in the Deptford works from the very beginning, and are still actively engaged in the company's service. Foremost among these is, of course, Mr. Partridge himself, whose technical ability and charming personality are too well known to need description. To call Mr. Partridge indefatigable would be the barest justice; no personal effort is too severe or too distasteful for him to undertake it, be it crawling through boiler flues or designing new equipment, and his acquaintance with every individual item of his plant is intimate and expert.

The history of the Deptford station, like that of most pioneer undertakings, has been one of innumerable difficulties and continual change; we are glad, therefore, to record the triumphant outcome of its long battle. Its total working costs for the year 1911 were 0·82d. per unit—about 19 per cent. lower than those of any other company in London for that year. We offer our congratulations to Mr. Partridge, with the hope that a bright and prosperous future may lie before his historic undertaking.

NOTES.

(*Concluded from page* 218.)

Devonport Dockyard Trip to Guernsey.—About 140 members of the Electrical Engineers' Department of H.M. Dockyard, Devonport, including the chief of the department, Mr. Z. H. Kingdon, took part in a trip to Guernsey during the August bank-holiday week-end. The party embarked on the G.W.R. steamer *Antelope* at the Millbay Docks, Plymouth, about 10.30 p.m. on the Friday night, arriving at St. Peters Port, Guernsey, about 6.30 a.m. on the Saturday morning. After landing, the party were photographed, and then proceeded in chars-à-bancs to the Masonic Hall, where breakfast was served. The party spent all day Saturday and Sunday visiting the chief places of interest, and left St. Peter's Port, Guernsey, on the Sunday night at 10.30 p.m., arriving at Millbay Docks about 7 a.m. on Monday morning. The weather was not all that could be wished, but the enjoyment of the party was little interfered with.

Post Office Engineering Staff.—In the Parliamentary questions the other day, Mr. Snowden asked the Postmaster-General whether, in view of the fact that the special board appointed to inquire into and report upon the cases of those engineers denied the new scales of pay authorised under the reorganisation of the engineering department completed their labours some weeks ago, and also that the delay which had taken place in announcing the result of the reconsideration was giving rise to a feeling of unrest and discontent amongst the officers affected, he would give some indication of the nature of the points of difficulty not yet settled. The Postmaster-General replied that he had now been able to come to a decision on this matter, and he found that he would be justified in granting the new scales of pay to a considerable number of engineers who were left on their old scales in the first instance. The changes would take effect as from July 1st, 1911.

Electric Light Staff (General Post Office).—Mr. Crooks asked the Postmaster-General the other day whether he was aware that the men in the electric light department of the General Post Office who were promised an increase of salary to commence January, 1908, had not yet received it, and would he make arrangements to enable these men to receive their long-delayed back pay. Mr. Herbert Samuel stated that the payment of arrears to the electric light staff, consequent on the antedating of their revised rates of pay from October, 1910, to January, 1908, had already been carried out in a number of cases, and the settlement of the remaining claims was being proceeded with; the amount of work involved was considerable, as it was necessary to make a week-to-week examination of the pay-sheets for each man concerned during two years and threequarters.

A Liverpool Charge.—At the Liverpool Police Court on Saturday, August 3rd, Arthur Evans Kennedy, electrical engineer, was committed to the Assizes for trial on a charge of menacing Sir Charles Petrie (chairman of the Tramways and Electricity Committee) by sending threatening letters demanding money. The case for the prosecution showed that Kennedy was formerly employed in the electricity department of the Corporation, and after his discharge for unsatisfactory conduct he commenced to write letters and address public meetings with the object of showing that he had a grievance against Sir Charles Petrie, Mr. Clough (city electrical engineer), and Mr. J. Witter (foreman). He had previously, in 1909, spent six months in prison in default of entering into recognizances in respect of a charge of writing a letter to Sir Charles Petrie. The letter complained of in the present case dealt with what he styled "The Liverpool Dreyfus case," and contained a sentence: "I further tell you that no matter what it costs, you will be bound to settle the matter between us." Further he wrote: "If you do not care to meet me, send to me what is known as a blank cheque and a letter. I have a price, of course. I will then write you out a receipt in full settlement of my claim against you, Mr. Clough, and Mr. Witter."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with th technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the offices of the Guernsey Electric Light and Power Co., Ltd., recently, MR. C. T. WESTLAKE, chief assistant engineer, was presented by the staff and employés with an onyx timepiece on the occasion of his marriage. Mr. A. N. Rye, the engineer and manager, made the presentation.

A proposal to increase the salary of MR. W. CHURCHYED, station engineer at Bridlington, from £156 to £166 per annum, has been referred back. The Committee made its recommendation after Mr. Churchyed had received a Lowestoft appointment, the chief engineer (Mr. Beckett) not desiring to lose his services at Bridlington.

MR. G. D. VICKERS, station superintendent at the Smethwick power station of the Shropshire, Worcestershire and Staffordshire Electric Power Co., has been presented with a handsome chiming clock in fumed oak case (subscribed for by the management and staff of the company) in celebration of his marriage, which took place at Blackburn on July 18th last.

MR. E. CALVERT, electrical engineer to the Finchley undertaking, has had his salary raised from £575 to £600 per annum.

The Newcastle-under-Lyme T.C. has increased the salary of MR. A. J. C. DE RENZI, electrical engineer, by £25 per annum, as from August 1st, with a further increase of £25 a year hence.

The Tunbridge Wells T.C. has decided to postpone until after October 30th the appointment of a chief electrical engineer in succession to Mr. J. W. Beauchamp. Until a successor is appointed MR. J. BEMROSE, chief assistant electrical engineer, will have charge of the undertaking.

MR. J. D. KNIGHT, borough electrical engineer at Ealing, has been unanimously voted an increase in salary from £575 to £600, commencing September 30th next. Increases, amounting to £69 11s. for the ensuing half-year, have been granted to all the staff at the electricity works.

General.—As reported in the Press, among the five Englishmen who were arrested on Saturday night at Eckenförde, near Kiel, on suspicion of espionage, are Messrs. W. R. MACDONALD, electrical engineer, and L. H. SHEFFIELD, solicitor, who are co-directors of Submersible Motors, Ltd.

The Council of the Institution of Civil Engineers has resolved to propose at the next meeting the election of MR. THOMAS COLTRIN KEEFER, C.M.G., of Ottawa, Canada, as an honorary member of the Institution, because of the distinguished part he has taken in the engineering enterprises which have aided so largely the development and prosperity of the Dominion; and on account of the services which he has rendered to civil engineering during his long association with it since his entry into the profession in the year 1838.

MR. H. S. WATKINS sailed on August 2nd for Ceara, Brazil, to supervise the construction of a complete tramway and electric light installation and power station, on behalf of the consulting engineers, Messrs. McCarter and Kerr Bock. Mr. Watkins anticipates being in Ceara for about 12 to 18 months.

CAPT. J. R. GARWOOD, Royal Engineers, has been appointed chief instructor at the Army School of Electric Lighting at Portsmouth.

The Perth (W.A.) City Council, after a three hours' debate, has appointed MR. HERBERT BROADBENT to prepare plans and specifications for the new city electric lighting installation and to supervise the carrying-out of the work when it is taken in hand.

MR. J. SUTHERLAND WARNER has returned to England from the United States, where a number of cars equipped with St. Louis-Warner Non-Parallel Axles, and manufactured by the St. Louis Car Co., of St. Louis, Mo., U.S.A., are now in operation.

NEW COMPANIES REGISTERED.

Galletti's Wireless Telegraph and Telephone Co., Ltd. (123,499).—Registered July 30th, by Bristows, Cooke and Carpmael, 1, Copthall Buildings, E.C. Capital £155,000 in 150,000 shares of £1 each and 100,000 shares of 1s. each. Objects: To acquire the benefit of certain inventions connected with wireless telegraphy and telephony, and apparatus, instruments and appliances connected therewith, to develop and turn to account the same; and to manufacture and supply machines, instruments and apparatus for use in connection therewith. The signatories (with one share each) are:—T. W. Stratford-Andrews, 18, Old Broad Street, E.C., managing director; R. C. Galletti, 23, Quai du Mont Blanc, Geneva, engineer. Private company. The first directors (to number not less than two or more than seven) are J. H. Tritton, Sir Francis Mowatt, G.C.B., Sir William R. Brock, K.C.I.E., R. C. Galletti, A. N. K. Macklin, C. Holland and T. W. Stratford-Andrews; qualification £250; remuneration (except managing or technical directors), £100 each per annum (chairman £150) and a percentage of the profits.

A letter from the G.P.O., London, to the Indo-European Telegraph Co. conveys the consent of the Postmaster-General to this registration, provided that such consent confers no right to use the system in the U.K. without the usual licence, and does not in any way bind the Postmaster-General to grant such a licence. The same letter states that the Postmaster-General has no objection to raise to the revised Memorandum of Association of the Indo-European Telegraph Co.

Vacuum Electric and Gas-Heating Appliances, Ltd. (123,645).—Registered July 31st, by C. R. Cran, 15, New Broad Street, E.C. Capital £100,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in geysers and appliances for the heating of steam, water and air by electricity, gas, oil or other method, and fittings and appliances connected with electric, gas and oil lighting, founders, electrical engineers, oil refiners, &c., to acquire, work, develop and turn to account certain inventions and patent rights for the heating of steam, water and air by gas and electricity, and to adopt an agreement with J. Mann. The subscribers (with one share each) are:—M. F. Berkeley, 2, Ormonde Terrace, Regent's Park, N.W., gentleman; O. Cuffe, Finsbury Circus Buildings, E.C., gentleman; D. W. Cassy, 133, Cannon Street, E.C., insurance broker; G. J. Smith, 20, Adamson Road, N.W., gentleman; C. G. Chatterton, 32, Finsbury Square, E.C., solicitor; Alice J. Ash, 28, Woodlands Road, Leytonstone, clerk; R. I. Marsden, 18, Eldon Street, E.C., chairman and secretary. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than 10) are M. F. Berkeley, O. Cuffe and G. J. Smith; qualification, 100 shares; remuneration £200 each per annum (chairman £250).

African Mica Mines, Ltd. (123,517).—This company was registered on July 31st, with a capital of £40,000 in 5s. shares, to acquire, work, develop and turn to account mica mines, mining rights and properties in Africa and elsewhere, and to adopt agreements with P. F. Haupt and the V.R. Syndicate for the acquisition of mica property in North-Eastern Transvaal. The subscribers (with one share each) are:—C. E. Gudgeon, 19, Eastcheap, E.C., asbestos merchant; W. E. Reiffenstein, 1, Cromwell Mansions, Ravenscourt Park, W., director; H. A. Corbett, 64, Erithville Gardens, W., gentleman; J. S. Home, 75, Grand Parade, N., journaliist; L. H. Rusby, 73, Cheapside, E.C., chartered accountant; T. Grimes, 19, Eastcheap, E.C., traveller; W. T. Veroni, 65, Fenchurch Street, E.C., gentleman. Minimum cash subscription, seven shares; the number of directors is not to be less than two or more than seven; the first are J. B. Gates and C. E. Gudgeon; P. F. Haupt shall become a director after first allotment of shares; remuneration, £100 each per annum (chairman, £200), free of income-tax. Registered office, 73, Cheapside, E.C.

Universal Wireless Supply Co., Ltd. (123,514).—This company was registered on July 30th, with a capital of £2,000 in £1 shares (200 founders), to carry on the business of manufacturers of, agents for, and dealers in wireless telegraph apparatus, machinery and implements of all kinds, &c., and to acquire the property and rights of T. H. Lyon and J. C. Smith in the patent Lyon-Smith detector. The subscribers (with one share each) are:—T. H. Lyon, 32, Morris Road, Southampton, master mariner; J. C. Smith, 23, Oxford Street, Southampton, marine optician; F. P. W. Allen, 70, Bullar Road, Bitterne Park, Southampton, wireless operator; H. E. Chalmers, 11, Hanley Road, Southampton, master mariner; H. Cook, 11, Arthur Road, Southampton, marine optician; F. Woolley, 5, Portland Street, Southampton, incorporated accountant; H. J. E. Batchelor, 63, Howard Road, Southampton, clerk. Minimum cash subscription, £500. The number of directors is not to be less than two or more than three; the first are T. H. Lyon and J. C. Smith. Registered office, 5, Portland Street, Southampton.

Southwold Electricity Works, Ltd. (123,568).—This company was registered on August 1st, with a capital of £10,000 in £1 shares, to take over the business carried on at Southwold and Reydon, Suffolk, for the electric lighting of the town of Southwold and parish of Reydon, and to adopt an agreement with the Coast Development Corporation, Ltd. The subscribers (with one share each) are:—Col. Sir Thomas S. Cave, Kilworth, Woking; C. F. Pritchard, 3, Temple Gardens, Temple, E.C., barrister; G. Riley, Granville House, Clacton-on-Sea, engineer; H. R. Spence, 5, Alexandra Court, Queen's Park, S.W., director; W. J. Taylor, 12, Ashgrove Road, Goodmayes, accountant; H. F. Worboys, 54, Brockley Rise, Honor Oak Park, S.E., clerk; C. J. Freeman, Elmcroft, Recreation Road, Sydenham, S.E., cashier. The first directors are Col. Sir Thomas S. Cave, C. F. Pritchard, G. Riley, and H. R. Spence. Registered office, Belle House, Fish Street Hill, E.C.

Gambrell Bros., Ltd. (123,557).—This company was registered on August 1st, with a capital of £10,000 in £1 shares, to carry on the business of manufacturers of and dealers in electrical instruments and appliances carried on by T. E. Gambrell and C. T. Gambrell, at 23, North Side, Clapham Common, S.W., as Gambrell Bros. The subscribers are:—F. W. Gordon, Graylands, Augustine Road, Wimbledon Park, Surrey, gentleman, 1,500 shares; T. E. Gambrell, 23, North Side, Clapham Common, S.W., electrical engineer, 1 share; C. T. Gambrell, 23, North Side, Clapham Common, S.W., electrical engineer, 1 share. Private company. The number of directors is not to be less than two or more than six; the first are F. W. Gordon, T. E. Gambrell, and C. T. Gambrell; qualification, £100; remuneration, £15 per annum, divisible. Registered by Druces & Attlee, 10, Billiter Square, E.C.

Maximum Magneto Co., Ltd. (123,507).—This company was registered on July 30th, with a capital of £5,000 in £1 shares to acquire inventions relating to motor-cars and motor-car parts, to promote companies, &c., and to adopt an agreement with W. H. F. Muenz, J. Sherwood, H. M. Harris and B. J. Samuels. The subscribers (with one share each) are:—B. J. Samuels, 10, Dean Street, W., motor accessory dealer; J. Sherwood, 26, Red Lion Square, W.C., merchant. Private company. The first directors are H. M. Harris, C. Oppermann, B. J. Samuels, J. Sherwood and F. Kubler; remuneration as fixed by the company. Registered office, 10, Dean Street, W.

Photos Miners' Electric Lamp, Ltd. (123,479).—This company was registered on July 29th, with a capital of £5,000 in 4,700 10 per cent. preferred ordinary shares of £1 each and 6,000 deferred ordinary shares of 1s. each, to carry on the business of electrical and mechanical engineers, electricians, &c., and to adopt an agreement with K. R. Smith for the acquisition of the patents, inventions and rights referred to therein. The subscribers are:—K. R. Smith, Woodlands, Paignton, South Devon, inventor and patentee, 900 preferred ordinary shares; E. R. Smith, Melford Lodge, Muswell Hill, N., stockbroker, 925 preferred ordinary shares; G. W. Cook, 3, Broad Street Buildings, solicitor, 50 preferred ordinary shares. Private company. The number of directors is not to be less than two or more than five the first are E. R. Smith, K. R. Smith and G. W. Cook. Registered by Waterlow & Sons, Ltd., London Wall, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Windermere and District Electricity Supply Co., Ltd. 41,461).—Trust deed dated June 25th, 1912 (supplemental to trust deed dated November 11th, 1902, securing £20,000 first mortgage debenture stock), charged on land at Troutbeck Bridge, and company's other property, present and future, including uncalled capital and benefit of all present and future provisional orders for electrical lighting. Trustees: A. M. Sing, Dawstone, Windermere; and A. H. E. Wood, Browhead, Windermere. The supplemental deed extends time for repayment of stock until December 31st, 1932, and increases rate of interest from 4½ to 5 per cent. per annum and otherwise varies principal deed.

Cleveland and Durham Electric Power, Ltd. (89,539).—Charge dated May 29th, 1912 (supplemental to agreement dated June 13th, 1911), to secure £31,600 or such other sum as may be payable under the terms of the agreement. Property charged: Above-mentioned agreement relating to generating and other plant at or near Horden and Shotton Collieries, and benefit of wayleaves and leases required for carrying out the same. Holders: Industrial Plant Co., Ltd., Milburn House, Newcastle-on-Tyne.

British and Colonial Lighting Co., Ltd. (100,650).—Issue on June 25th, 1912, of £500 debentures being part of a series of which particulars have already been filed.

Callender's Share and Investment Trust, Ltd. (121,778).—Trust deed dated March 30th, 1912, to secure £115,000, charged on securities amounting in all to £115,000 in the Anchor Cable Co., Ltd., Lancashire Power Construction Co., Ltd., Yorkshire Electric Power Co., and the Uxbridge and District Electric Supply Co., Ltd., and the company's undertaking and property, present and future, including uncalled capital. Trustees: Sir Henry S. King, K.C.I.E., 65, Cornhill, E.C., and Sir James F. Flannery, Bart., M.I.C.E., 9, Fenchurch Street, E.C.

Power Gas Corporation, Ltd.—Agreement dated July 9th, 1912, to secure all moneys not exceeding £75,000, which the mortgagees may pay to Parr's Bank, Ltd., under or by virtue of a certain guarantee, charged on Parkfield Works, at Stockton-on-Tees, contained in mortgage to the Corporation by virtue of deposit of deeds, to secure not more than £100,000. Holders: R. L. Mond, J.P., Combe Bank, Sevenoaks; Sir Alfred M. Mond, Bart., 35, Lowndes Square, W.; E. S. Mond, 22, Hyde Park Square, W.; and B. F. Hawkesley, 30, Mincing Lane, E.C.

Reason Manufacturing Co., Ltd. (64,701).—Mortgage dated July 4th, 1912, to secure £2,600, and any other present or future indebtedness of the company to the mortgagees (Barclay & Co., Ltd., 54, Lombard Street, E.C., and North Street, Brighton), charged on present and future indebtedness of company's customers.

Barbados Electric Supply Corporation, Ltd. (104,367).—Particulars of £15,000 debentures created June 27th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital, and sums payable in respect of 4,828 preferred and participating shares unissued, and/or any new shares hereafter created and issued. No trustees.

Luken Co., Ltd.—Debenture for £1,200 dated July 4th, 1912, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: The Lunkenheimer Co., Cincinnati, Ohio, U.S.A.

Foster Engineering Co., Ltd. (94,371).—Particulars of £10,000 debentures, created May 31st, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Evershed & Vignoles, Ltd. (43,206).—Issue on June 28th, 1912, of £4,500 debentures, being balance of a series for £15,000, particulars of which have already been filed.

Indicating Fuse and General Manufacturing Co., Ltd.—Debenture dated June 28th, 1912, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Capt. W. J. Seton, Trunk Cottage, Cove, Farnborough, Hants.

Aluminium Corporation, Ltd. (106,421).—Trust deed dated June 17th, 1912, to secure £10,000 second mortgage debenture stock, charged on certain lands and premises in Carnarvonshire, and rights, privileges and powers, &c. Trustees: Mortgage Investment and Contract Corporation, Ltd., 60, London Wall, E.C.

Durell Walker & Co., Ltd.—Particulars of £1,000 debentures, created July 15th, 1912, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital (if any). No trustees.

British Union Lamp Works, Ltd.—Particulars of £10,000 debentures, created June 26th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Urban Electric Supply Co., Ltd. (57,986).—Return dated June 12th, filed June 27th, 1912; capital, £640,000 in 80,000 ordinary shares of £8 each; 50,000 preference shares of £5 each and 150,000 shares of £1 each; 80,000 ordinary and 50,000 preference shares taken up; £8 per share called up on the ordinary and £5 per share on the preference; £490,000 paid. Mortgages and charges: £356,723.

Union Electric Co., Ltd. (71,115).—Return dated May 6th, filed May 9th, 1912; capital, £25,000 in £1 shares; 24,250 shares taken up; £1 per share called up on 4,250 and 1s. per share on 19,500; £5,225 paid; £500 considered as paid on 500 shares. Mortgages and charges: Nil.

Northwood Electric Light and Power Co., Ltd. (66,312).—Return dated June 21st, filed July 12th, 1912. Capital £30,000 in £1 shares (15,000 5 per cent. cumulative preference). 12,357 ordinary and 6,730 preference shares taken up. £1 per share called up on 8,132 ordinary and 6,730 preference. £14,862 paid. £4,225 considered as paid on 4,225 ordinary. Mortgages and charges: £4,875.

Rhymney Valley and General Electric Supply Co., Ltd. (89,413).—Return dated June 17th, filed July 1st, 1912. Capital £5,000 in £1 shares (2,500 preference). 1,877 ordinary, and 140 preference shares taken up. £1 per share called up on 1,200 shares. £1,110 paid, leaving £90 in arrears. £817 considered as paid on 817 shares. Mortgages and charges: £1,100.

Shanghai Electric Construction, Ltd. (86,795).—Return dated May 30th, 1912, filed same date. Capital £320,000 in £10 shares. All shares taken up. £317,000 paid. £3,000 considered as paid. Mortgages and charges: Nil.

Rangoon Electric Tramway and Supply Co., Ltd. (86,932).—Return dated May 14th, filed June 29th, 1912. Capital £500,000 in 50,000 preference shares of £5 each and 250,000 ordinary shares of £1 each. 50,000 preference and 177,001 ordinary shares taken up. £5 per share called up on 50,000 preference and £1 per share on 112,001 ordinary. £361,999 paid, leaving £2 in arrears. £65,000 considered as paid on 65,000 ordinary shares. Mortgages and charges: £198,896.

Birmingham and Midland Tramways, Ltd. (19,077).—A memorandum of satisfaction in full on February 29th, 1912, of mortgages advised as outstanding under Sec. 12 of Company's Act, 1907, securing £4,750, has been filed.

Woking Electric Supply Co., Ltd. (46,175).—Issues on various dates from February 8th to June 8th, 1912, of £2,850 debentures, parts of a series of which particulars have already been filed. A memorandum of satisfaction to the extent of £3,000 of trust deed dated March 1st, 1906, securing an indefinite amount, has also been filed.

Leatherhead and District Electricity Co., Ltd. (70,637).—Trust deed dated July 2nd, 1912, to secure £15,000 debenture stock, charged on land in Fetcham, Surrey, with buildings thereon and company's other assets, present and future, including uncalled capital. Trustee: P. P. Ralli, Ashstead Park, Surrey.

A. Reyrolle & Co., Ltd. (70,210).—Issue on July 12th, 1912, of £300 debentures, part of a series of which particulars have already been filed.

Roger Dawson, Ltd.—Deed of charge on 1, Berners Street, Oxford Street, W., and a sinking fund policy, dated July 17th, 1912, supplemental to mortgage dated June 18th, 1908, securing £6,500 and further advances, now £9,500. Holders: Alliance Assurance Co., Ltd., 1, Bartholomew Lane, E.C.

Safety Light, Ltd.—Particulars of £17,500 debentures, created June 21st, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being issued on July 3rd, 1912. Property charged: The company's undertaking and property, present and future. No trustees.

CITY NOTES.

Central London Railway Co.

THE half-yearly meeting was held on Thursday last week at the Holborn Restaurant, Dr. H. F. Parshall presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, p. 184), said that during the half-year the balance of the 4½ per cent. preference stock, £95,000, had been issued. The capital expenditure had been £78,501, the principal item, namely, £71,991, being in respect to the Liverpool Street extension. Notwithstanding the difficulties under which that work had been carried out owing to industrial unrest and the very considerable delay caused thereby in the delivery of all kinds of materials, this extension was opened for public traffic on July 28th. Great credit was due to the contractors as well as to their own staff in having achieved that result. It was, of course, too early to say what benefit the company would derive from the extension, but during the past few days it had been a great convenience to the public, and they had every reason to believe that it would prove to be a valuable source of revenue to the company. As regarded further capital expenditure, there was to be spent on Liverpool Street during the coming half-year £36,000 and in subsequent half-years £20,000, making a total of £56,000, to complete this extension. In connection with the Ealing and Shepherd's Bush extension the expenditure during the half-year would be £38,000, and in subsequent half-years £120,000, making a total of £158,000. Additional rolling stocks would cost £71,000. The completion of the Ozonair system of ventilation, installation of automatic signalling, fireproofing of platforms and sundry items would cost £23,000, making a total expenditure of £308,000. To meet this they had unissued debenture stock amounting to £160,000. There was also a small balance due in respect of the unissued 4½ per cent. preference stock of £600, which with the balance at credit of capital account of £165,526, made a total of £326,126. They would remember that the Metropolitan Railway Co., in the present session of Parliament, promoted a Bill whereby they sought to obtain running powers over the Ealing and Shepherd's Bush Railway. He was pleased to say that by the joint efforts of their company, and the Great Western Railway Co., the portion of the Bill affecting their railway was rejected. The Great Western Railway Co. were now pushing ahead as rapidly as possible with the construction of their portion of the line and work had been commenced on their connecting portion at Wood Lane. Turning to the revenue account, the railway last half-year had carried 17 million passengers which compared with the same period last year was a decrease of 2,757,000 passengers with a decrease in receipts of £18,875. The decrease in receipts was principally due to various forms of competition, mainly by motor-'buses. The coal strike in the early part of the year was also responsible for a portion of the decrease, since during that period there were generally fewer passengers travelling. There was also to be taken into account the fact that the receipts for June of last year were abnormal owing to the Coronation festivities. Against this decrease in passenger receipts there was an increase in miscellaneous receipts of £3,399, bringing the net decrease in revenue to £15,476. Against those decreases there had been effected a further reduction in the working expenses, which, including rates and taxes, amounted to £12,239 so that the balance to net revenue showed a diminution

of only £3,237. The percentage of working expenses to traffic receipts was 59·44 against 61·09 in the corresponding period last year, being an decrease of 1·65 per cent. The gross receipts amounted to £134,633, and after deducting working expenses amounting to £71,969, there was a balance to net revenue of £62,664. After providing for debenture interest and other payments amounting to £19,749, there was an available balance of £76,670, as compared with £76,878 last year. The interest on the 4½ per cent. preference stock amounted to £10,800. A dividend on the undivided ordinary stock at the same rate as last half-year, viz., 3 per cent., and 4 per cent. on the preferred ordinary stock, would take £30,538, leaving a balance of £30,238 to be carried to the next half-year. The season-ticket facilities had been very largely extended, and the greatest advantage had been taken by the public of the monthly seasons, and also the short-distance tickets.

The Right Hon. VISCOUNT ST. ALDWYN seconded the motion, and the report was adopted.

The CHAIRMAN, in reply to a question, said they had no idea of extending the line in the West End, except the Ealing extension which was near completion.

Indo-European Telegraph Co., Ltd.

AN extraordinary general meeting was held on Thursday last week, at the offices, 18, Old Broad Street, E.C., Mr. J. Herbert Tritton presiding.

The CHAIRMAN, in moving the resolution approving of a fresh clause (3) in substitution of the present clause in the memorandum of association, said that at the time when their existing memorandum was drafted, as far back as 1868, the practice in drafting such documents, and the law concerning their interpretation, seemed to have differed considerably from present usage. In those days it was the practice to state the main objects of the company in somewhat general terms, and to leave all subsidiary matters to be covered by general words, or to be provided for in the articles of association. According to present practice the reverse plan prevailed, namely, to define with some fulness and considerable precision in the memorandum of association the powers exercisable by the company, and to treat matters not so specifically authorised and defined as outside the powers of the company; and the authority of the directors or the power of the company to do any act was open to question, unless the act was in terms authorised by the memorandum of association. When they altered their articles in June, 1911, they expunged a good many of the directors' powers then contained in the articles as they obviously had no place in them, after they had revised them and brought them up to date. Consequently, the directors' powers remaining in the memorandum, as it stood before alteration, were very meagre—except by implication—in fact, as meagre as they possibly could be. The directors had hitherto avoided the revision of the memorandum (although strongly recommended by their legal advisers to do so) on account of the various complications involved in going to the concessionary Governments, the shareholders, and the High Court for approval. They felt, however, that they could not do justice to the business of the company which naturally became extended with succeeding years, without taking the alteration of the memorandum in hand, and they came to the shareholders for that purpose that day.

SIR FRANCIS MOWATT seconded the resolution, which was carried unanimously.

Metropolitan Railway Co.

THE half-yearly general meeting was held on Wednesday last week at the Great Eastern Hotel, E.C., the Right Hon. Lord Aberconway presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 186), said it was of a satisfactory character, having regard to the adverse conditions under which they had been working during the past six months. The receipts showed a decrease of £9,000 and the expenditure a decrease of £4,000. The traffic decreases were in the carriage of passengers and coal. The strike amongst the miners throughout the country was the direct cause of the falling off in their coal traffic, and was one of the causes of the falling off in their passenger traffic. He was happy to say that throughout the period of the strike they were able to maintain a very efficient service of trains over their system, and when it was over they had still several weeks' supply of fuel at their works. In view of the labour difficulties generally, they adopted a policy some 12 months ago of keeping a considerable stock of power-house coal stored at Neasden, and when the recent miners' strike became imminent they increased that stock to what they considered a sufficient extent to tide over the stoppage at the pits. In this way they were able at very small increased expense to run their train services without interruption, and with only a few modifications, during the slack periods of the day. They were still feeling the effects of increased 'bus competition, but they were doing all that they could to meet the situation by offering counter-attractions by their frequent, regular, and comfortable services. Their receipts from season tickets had advanced by nearly £2,000, which was evidence of the growing popularity of the line. On the expenditure side of the account the only items that called for mention were the locomotive and generating expenses, which were down to the extent of £4,000, and carriage and wagon repairs, which showed a saving of about £1,800. With regard to the first of these items, he thought, considering the higher price they had had to pay for coal during the last half-year, it was exceedingly gratifying to be able to show so substantial a reduction in the cost of their electrical power. They had now three of their reconstructed machines in commercial operation at Neasden, and they were showing very favourable results. From their experience up to the present time he had no hesitation in saying that, when the whole of the work was completed, the results in economical working would fully justify their expectations. While on that subject he would remind them that they were paying for the replacement of the machines out of the renewal fund which they had been building up for some years past, and their only charge to capital was such a proportion of the total cost as was represented by the increased productive capacity of the power house. They had during the half-year, by the introduction of more economical methods of working their steam services, made considerable savings in engine power and in the consumption of locomotive coal. In the net revenue account the only item calling for special mention on the debit side was the electrical renewal and depreciation fund, to which they proposed to place £7,500 this time compared with £5,000 12 months ago. They had already proved the usefulness of that fund, and he was sure they would agree with him that it was a wise precaution to keep it up to a good level. The average fare per passenger during the last half-year had been 1·486d., as compared with 1·487d., and the ratio of expenses to gross receipts 48·91 per cent. compared with 48·82 per cent. in the corresponding period, while the ratio of expenses to traffic receipts alone was 54·42 per cent., compared with 53·98 per cent. last year. The balance available for dividend was £158,815, or £7,913 less than in the corresponding period. They had dividend to pay on increased ordinary capital which they had issued to the extent of £729,706 during the past half-year. They were able out of the balance to pay the full dividends on their several preference stocks, and also to pay a dividend at the rate of 1½ per cent. per annum on the full amount of their ordinary stock, and to carry forward £4,600, which was about £500 more than last year. He was sorry that it should be necessary to declare a somewhat smaller dividend than a year ago, but the circumstances had been entirely exceptional, and nearly all the companies whose accounts had been published up to the present time, and who had been affected by the deplorable strike among the coal miners, had had to show a smaller return for the half-year. The National Insurance Act would cost the company approximately £2,500 a year. The electrification of the East London line was being pushed on with, and they expected it to be completed in the early months of next year. As soon as this was done they would resume the running of through trains from their line to New Cross, and by arrangement with the other lessee companies they had undertaken to provide the rolling stock for, and to run, the local services on the East London line. There was a distinct community of interest between places served by the East London line and certain parts of their system, and they looked forward to a very considerable development of traffic from the new services that would thus be opened up. The Bill that they promoted in the present session of Parliament for the making of a branch line at Watford and for the widening of their existing line between Finchley Road and Wembley had, notwithstanding the strenuous opposition of the L. & N. W. Co., passed both Houses of Parliament, and was now awaiting the Royal Assent. He explained at the Wharncliffe meeting last January their reasons for promoting this Bill, and he thought that they were entitled to assume from the fact that after very searching inquiry before Committees of both Houses the powers they sought had been granted, that they were right in their judgment as to the necessity for the two extensions they had in view. He did not think that their friends the North-Western Co. need fear that they would permanently affect their business in Watford, because they considered that their advent there would tend to such a development of the place that any traffic they lost in the first instance they would regain later on by the general enlargement of the town. During the last half-year they had increased their ordinary capital to the extent of £729,000. As they knew, it was some time since they raised any new capital, and as they had been expending in various directions their capital account became overdrawn, and they had in hand and in prospect various works which would cost a considerable amount of money. They had been waiting for some time for a favourable opportunity to get out some new stock, and when the price of the ordinary stock rose a few weeks ago they took advantage of the situation to sell the stock which they had created but not issued. The transaction was an eminently satisfactory one from the point of view of the price they obtained for the stock, and their capital account was now well in credit. While the past half-year had not shown as satisfactory a result as some preceding half years, there had been very exceptional circumstances operating against them, and his colleagues on the board and he saw no reason to alter the view they had expressed to them previously, namely, that if they could be secure from unfair competition they had every reason to be optimistic as to the future of the line. Their undertaking was sound in every way, it met, and met well, a great public demand, and with the continuance of a liberal policy on the part of the board and the assistance of a zealous staff of officers and men, they thought that they might look forward with confidence to a better return on the capital that they had invested in the company.

LT.-COL. CLIFFORD PROBYN seconded the motion and the report was adopted.

Brompton and Kensington Electricity Co., Ltd.—The directors announce an interim dividend at the rate of 9 per cent. per annum.

Liverpool Overhead Railway Co.

In their statement for the half-year ended June 30th, the directors report that the gross revenue receipts amount to £41,407, and the working expenses to £28,313.

The number of passengers carried during the last two years is as follows :—

	Half-year to December, 1910.	Half-year to June, 1911.	Half-year to December, 1911.	Half-year to June, 1912.
First class	567,911	579,328	617,097	628,352
Third class (incldg. trmwys.) ..	3,260,261	3,113,073	3,898,069	3,323,291
Workmen (spec. ret. tickets) ..	1,563,128	1,701,196	1,723,340	1,919,696
Total.. ..	5,391,300	5,393,597	5,738,506	5,871,339

The improvement in the extent of the traffic during the past half-year is an encouraging feature. The coal strike increased the working expenses, but a service was maintained throughout the trouble, which proved a great convenience to the trade of the Port. The permanent way and rolling stock are in excellent condition.

The receipts from passenger traffic were £40,082, and miscellaneous receipts and interest £1,325, making £41,407, less working expenses and transfer to renewal fund £28,313, leaving £13,094. After deducting interest on mortgage debentures, and on calls paid in advance £4,329, there remains £8,765, plus £4,763 brought forward, leaving available for dividend £13,528, out of which the directors recommend dividends at the rates of 5 per cent. per annum on the preference shares, and 2 per cent. per annum on the ordinary shares, payable on and after August 15th, leaving £4,852 to be carried forward.

The meeting is called for August 13th.

Metropolitan District Railway Co.

The half-yearly meeting was held on Thursday last week at the Westminster Palace Hotel, S.W., Lord George Hamilton in the chair.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 185), said the half-year had to be compared with the six months of the previous year, when the receipts were abnormally increased by the Coronation festivities. During the past half-year they had had no assistance of that kind, but instead they had had to deal with two strikes, both of which had materially affected them. They had been obliged to pay a large sum to ensure a supply of coal during the coal strike, and they had also been put to considerable expense to get coal up the river to their power house at Chelsea owing to the dock strike. Yet, notwithstanding those untoward expenses, the gross revenue had amounted to £344,000, being an increase of £9,800 over that of the corresponding half of last year. The working expenses showed an apparent decrease of £13,000, but that was due to a change in the form of accounts necessitated by the acquisition of the power house undertaking by that company and the London Electric Railway Co. The cost of electric train working for the half-year amounted to £63,373, as compared with £79,215, showing a decrease of £16,000, but in addition they had had to pay £17,212 as rent for the Lot's Road power house. Speaking generally, the acquisition of the Lot's Road power house by the railway companies had quite fulfilled their anticipations. It had been a distinct advantage to them, as it had given them control of their own supply of energy, and if they were fortunate enough to make contracts by which they could sell their surplus power to outside companies the cost of supply to themselves ought to be diminished. The balance of net revenue amounted to £83,491, against £82,900. They were able to pay the full dividend of 4 per cent. on the guaranteed stock, 4½ per cent. on the preference stock, and 2 per cent. on the second preference. That payment of 2 per cent. on the second preference gave the holders of that stock 2 per cent. for the whole year. He hoped that as their progress went on they would be able to gradually increase that dividend until it attained its maximum of 5 per cent., and then there would be nothing to intervene between the ordinary shareholders and a dividend. During the last half-year £150,000 prior lien debenture stock had been sold to provide the cost of additional rolling stock and various other improvements. Apart from that issue, the capital expenditure during the half-year was £30,744, and they estimated their further capital expenditure in subsequent years at £143,000. The train service continued to show substantial improvement, especially in the western extension, and there were two very satisfactory facts in connection therewith. The first was that the train-mileage showed an increase of 640,000 miles, notwithstanding which the earnings per car-mile were 9·59d., an increase over the corresponding period last year of ·19d. The increase in passenger receipts was £11,862; the parcels and goods traffic showed a small decrease of £410, and season tickets showed an increase of £6,014. The first class ordinary receipts showed a decrease of £348, or 1·94 per cent, and the third class, including workmen's trains, an increase of £6,196, or 2·48 per cent. The number of passengers carried was 42,910,000, being an increase of 1,406,000 or 3·39 per cent., which constituted in itself a record in the history of the company as to the number of passengers carried in any one half-year. Considering the difficulties under which they had had to work during the past half-year, he thought it would be generally admitted that the net result was satisfactory, particularly when they took into consideration that their traffic, especially for short distances, was affected by the motor omnibus. The Insurance Act would cost the company about £1,600 per annum. Dealing with the general situation, he would point out that during the past 12 months they had had to deal with three strikes, all affecting the transport service of the country. They first had the railway strike of last autumn, they then had the coal strike of last spring, and they were only just emerging from the throes of the dock strike. He wished to make only one comment on those strikes. The attention of everyone who took an interest in the social welfare of this country had been directed towards the rise in price of the necessaries of life during the past few years. Every strike of this kind tended to aggravate that rise, for in each one of the strikes to which he had alluded, the price of some necessities of life went up in consequence, and they did not return to the figure at which they were before the strike. It was well to bear the fact in mind that these strikes did not merely affect the employer and employed, but they prejudicially affected, in their after consequences, the consuming interests of the whole working classes of the country. Let them sincerely hope that, if differences of opinion should arise in the future between those managing railroads and their employés, that some form of settling the difference would be taken less suicidal to the interests of the wage-earning class than those to which he had alluded.

Sir Charles Dalrymple, Bt., seconded the motion, and the report was adopted.

London Electric Railway Co.

The half-yearly meeting was held on Thursday last week at the Westminster Palace Hotel, S.W., under the presidency of Lord George Hamilton.

The Chairman, in moving the adoption of the report (see Electrical Review, page 186), said that the traffic and the working expenses had been both affected adversely during the half-year under review by the coal strike and the transport strike. They had caused the expenditure of large sums to secure the necessary coal supply, and, as a result, the train services were not materially affected during the strike, but a true comparison between the period under review and the corresponding six months of 1911 was almost impossible, as they were comparing with the Coronation half-year. The gross recepts had amounted to £389,011, being a decrease of £3,800, and taking into account the different circumstances prevailing, that small decrease was not unsatisfactory. The working expenses showed an apparent decrease of £18,750, but that decrease was apparent rather than real. In previous half-years, the charge for the use of the electrical plant was part of the operating expenses. Since the acquisition of the Lot's Road power house, that charge appeared in another form as rent, amounting to £15,900. The ratio of working expenses throughout the lines to gross receipts was 40·143 per cent. The passenger receipts showed a decrease of £6,000, but advertising was up some £1,900. After providing for all fixed charges and setting aside £7,500 for renewals, they had a balance of £121,653 available for dividends, sufficient to pay the full dividend of 4 per cent. on the preference stock, and 1 per cent. on the ordinary, carrying forward a balance of £12,014. The traffic, especially the short distance, had been adversely affected, both by motor-omnibuses and the L.C.C. tramways. The company's Bill had passed both Houses of Parliament, and was only awaiting the Royal Assent. The only change of any importance made in the Bill was the deletion of a provision for an exit to the street at the Oxford Circus Station. The necessary plans for the extension of the railway connecting the Bakerloo line with the London and North Western Railway at Queen's Park were in preparation, and the extension of the Hampstead line from Golder's Green to Edgware had also advanced, and they hoped to commence actual work on both sections at an early date. The capital expenditure during the half-year had amounted to £76,600, of which £24,000 was spent on the Charing Cross extension and £39,000 on the Paddington extension. They hoped that both those important developments would be completed and in working order in the course of the year. To complete the two extensions authorised and to provide escalators at certain stations, they estimated that further capital expenditure amounting to £461,000 would be required. The Insurance Bill would cost the company about £1,500 a year, and they had formed an approved society for their employés, the solvency of which would be guaranteed by the company.

Sir Algernon West, G.C.B., seconded the motion which was adopted.

Metropolitan Electric Tramways, Ltd.—An extraordinary general meeting is called for August 14th at Electrical Federation Offices, W.C., to confirm the resolutions as to capital rearrangement passed on July 26th.

"Harper" Electric Piano (1910) Co., Ltd.—The directors announce a dividend at the rate of 3½ per cent. for the half-year to June 1st.

Mather & Platt, Ltd.—The directors have declared an interim dividend on the ordinary shares of 5 per cent., being at the rate of 10 per cent. per annum, free of income-tax, for the half-year ended June.

Oldham, Ashton and Hyde Tramways Co., Ltd.—The directors have declared an interim dividend of 5 per cent. per annum on the ordinary shares for the half-year.

Porto Rico Railways Co., Ltd.

In their report for 1911 the directors state that the gross earnings amounted to $748,802, as compared with an increase of $187,140, or 33·32 per cent. The net income was $379,784, an increase of $112,025, or 41·84 per cent. After providing for interest on bonds and dividends on preferred stock, the surplus was $199,559, being equal to 6·65 per cent. on the common stock. This surplus has been appropriated as follows:—Sinking fund on first mortgage bonds, $29,040; transferred to contingent account, $25,000; dividends on common stock, last two quarters of year, $60,000; transferred to surplus account, $85,519.

The number of passengers carried by the tramway was 6,344,334, an increase over the previous year of 1,337,093, equal to 26·73 per cent. The extension of the tramway lines through the new suburb "Condado" was completed during the year, and the earnings from same have been satisfactory.

The light and power division continues to show satisfactory progress, the number of customers being 5,200, an increase of 714 during the year. The following comparative statement shows the addition in connected load during the year:—

	1911.	1910.	Increase.
Commercial Incan. Lamps connected	60,983	48,623	12,360
Arc Lamps	396	365	31
Municipal Incandescent Lamps	937	728	209
Electric Fans	745	611	134
Motors	1,001 H.P.	449 H.P.	552 H.P.
Heating Appliances	253	228	25
Total Load (16-c.p. equiv.)	81,276	56,588	24,688

Good progress has been made in the construction of the new storage dam and extension of the power house at Comerio. The transmission lines have been extended to Naguabo and are now being extended to San Lorenzo, Toa Baja, Toa Alta, Dorado, Vega Alta and Vega Baja, contracts having been closed with these municipalities. Extensive improvements and additions have been made to the auxiliary steam plant and sub-stations. Additional yard room has been provided for the handling of freight at the various terminals, and further sidings have been constructed where necessary. In all, there has been expended on capital account during the year $551,751. An application has been made for a franchise authorising the extension of the transmission lines to towns in the north-western and south-eastern parts of the island not covered by existing franchises.

In view of the company's greatly improved financial position, and of the large capital expenditures necessary by reason of the rapid development of the property, the board had decided not to issue at present the $500,000 of additional preferred stock authorised and they asked approval to an issue of £1,500,000 5 per cent. 50-year refunding general mortgage debenture stock and/or bonds. Of this amount it was proposed to issue £200,000 immediately to provide for capital expenditure already made and in progress. £600,000 of the issue would be held in escrow to be exchanged for first mortgage bonds outstanding. This would leave a balance of £700,000 available for future extensions as required.

During the year there was expended and charged to operating account on physical maintenance and improvement $104,854. Two quarterly dividends on the Common stock, at the rate of 4 per cent. per annum, were declared in respect of the last two quarters of the year. General conditions in the Island of Porto Rico are highly prosperous. The directors record their appreciation of the efficient services rendered by Mr. F. W. Teele, general manager, and all other officers in Porto Rico.

Company Registrations in 1912.—The returns of new Company Registrations for the first half of 1912 are remarkably satisfactory, says the *Investors' Guardian*, in its half-yearly review. The abnormal speculative movement which dominated the returns of 1910, and which was still operative last year, has died down, but the reaction has not affected other departments of enterprise. On the contrary, there is decided evidence of a strong and healthy expansion in joint stock enterprise. The number of companies registered in the half-year increased by 11·4 per cent., and the registered capital by £7,032,000, or 8·3 per cent. A notable feature of the statistics for groups of companies is the large amount credited to finance and investment concerns (nearly £10,000,000). Fifteen companies were registered with a capital of £1,000,000 and over, these 15 representing an aggregate of £24,500,000 capital. We extract the following figures:—

First half of	1910	1911	1912
Number of companies	3,744	3,102	3,458
Aggregate capital registered.—	£	£	£
Electric	1,522,507	509,145	1,628,500
Engineering and hardware	3,818,057	3,531,302	5,845,908
Gas	170,462	645,700	224,600
Railways and tramways	3,505,110	1,630,600	1,163,450
Rubber	86,627,740	8,004,505	1,762,010
Totals	131,328,169	85,066,982	92,099,698

The figures for the engineering trade reflect the greater activity in that industry; shipping also shows well. The motor industry takes a more prominent position than for several years. Textile manufacturing and drapery companies show steady development.

Continental.—France.—The report of the Société d'Energie Electrique du Littoral Mediterranéen for the last financial year shows a net profit of £66,361, as compared with only £58,938 in the preceding 12 months.

A company has lately been registered in Guernsey with the title La Compagnie Lyonnaise d'Entreprises Electriques et Téléphoniques, the capital being £8,000.

Montreal Light, Heat and Power Co.

We have now received a copy of the annual report of this company, to which brief reference was made on page 104 of our issue of July 19th. In addition to the points already mentioned, the directors touch upon the questions of depreciation and rates. In regard to the former they say that their policy is to amply provide from year to year for deterioration and obsolescence of plant, and while the reserves to date for this account represent a large amount, in the opinion of the directors it is none too large bearing in mind the nature of the company's business, and it will be necessary as heretofore to make adequate annual provision for this purpose. In respect to reduction in rates, they say that in pursuance of its adopted policy to sell its products at minimum rates consistent with the best possible service, the company has just announced a further reduction (effective from July, 1912, meter readings) in electric lighting and gas service rates, and it is expected, as heretofore, that additional business will compensate the resultant loss in revenue. In view of the repeated reductions in rates for electric service which the company has effected in late years, it will not be inopportune to mention that the City of Montreal has in contemplation an extensive system of underground conduits for the burial of wires, and incidentally the removal of poles from the streets in the commercial and congested districts of the city. The company has every sympathy with the city and citizens in this movement; at the same time, the fact must not be lost sight of that the low prevailing rates have been permitted, in large measure, by the relatively low investment cost for ærial or overhead service, and it is only fair to the shareholders to state that the extra capital entailed for underground service will inevitably increase the cost, and consumers will have to bear in mind that a fair differential in rates will be justified for this class of service as soon as the civic conduit system has been inaugurated.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

British Columbia Telephone Co., Ltd.—Fully-paid script for $400,000 4½ per cent. first mortgage debenture stock; and 5,000 6 per cent. cumulative preference shares of $100 each, fully paid.

General Electric Co., Ltd.—Further issue of 15,000 6 per cent. cumulative preference shares of £10 each, fully and partly paid.

The Committee has ordered the under-mentioned securities to be quoted in the Official list:—

Canadian Western Natural Gas, Light, Heat and Power Co., Ltd.—$311,648 5 per cent. first mortgage debenture stock.

Consolidated Gas, Electric Light and Power Co., of Baltimore.—Further issue of $350,000 general mortgage 4½ per cent. 30-year gold bonds of $1,000 each, Nos. 10,583 to 10,932.

Prospectus.—*Clevedon, Portishead, and District Electric Supply Co., Ltd.*—The prospectus is published offering 30,000 ordinary shares of £1 each at par out of a total capital of £50,000. The company has been formed under special agreements with the Urban District Councils of Clevedon and Portishead (Somerset), to establish an electric supply in those seaside resorts, together with a portion of the rural district of Long Ashton, the whole area having a total population of about 17,000. Public lighting contracts for a period of years in each case have been made with both the Urban District Councils of Clevedon and Portishead, and the company will receive from the start about £700 a year from this source. Negotiations have also been opened with three Parish Councils, and it is expected that similar contracts will be secured. The construction of the power house at Portishead is in progress, and it is hoped that the supply at Clevedon and Portishead will be available this year, and in the rural districts early next year.

Dublin and Lucan Electric Railway Co., Ltd.—The directors report that the gross receipts for the June half-year amount to £3,637, an increase of £182, whilst the expenditure is £23 less. After providing for debenture interest, and the half-year's dividend on the preference shares, £200 is put to renewals of overhead wire, and £445 is carried forward.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ended June 30th last at the rate of 8 per cent. per annum.

STOCKS AND SHARES.

Tuesday Afternoon.

In the August Bank-holiday week, and with the Stock Exchange in the middle of a nineteen-day account, there is so little going on that we are glad of the opportunity to look back upon what has happened during the progress of the year up to the present. So far as electric issues are concerned, the feature, beyond a doubt, is the enormous amount of business—and in many cases the dramatic rises which have occurred—in what, for want of a better name, we have to call the Latin-Canadian group.

There was a Home Railway boomlet in the spring, which fizzled out dismally as labour troubles involved the railway market as a whole. Speculation in Marconis and in National Telephone Deferred—the former especially—ran at a giddy pace, so much so that the boom in Marconis came to an ignominious

collapse; although, on balance, the prices show substantial rises since the beginning of 1912.

Coming to prices, the movements in electrical supply shares are very interesting in view of the rumours referred to repeatedly here as to the possibility of a general working agreement being arrived at between the companies and the local authorities. It will be noticed that there are a few big rises in the following list:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Brompton and Kensington, Ordinary ..	8⅛	8⅜	+ ⅛
Charing Cross, West End and City ..	3⅜	4⅜	+ 1
Chelsea, Ordinary	4⅛	4⅜	+ ¼
City of London, Ordinary	12⅞	18⅜	+ 5⅝
County of London, Ordinary	9⅞	11⅞	+ 2
Kensington and Knightsbridge, Ordinary..	7	7⅛	+ ⅛
London Electric, Ordinary	1⅝	1⅝	—
Metropolitan	3⅜	3⅜	—
St. James' and Pall Mall, Ordinary.. ..	8⅛	8⅜	+ ⅛
Westminster, Ordinary..	8⅛	8⅛	+ ⅛

The extraordinary rise in City of London shares is due, of course, to the expectation of the company being taken over by the Corporation, hopes of which are not yet wholly scotched by the categorical denials given by the company to the rumours that this was going to happen. Counties have followed much more soberly, the advance in their case being due mainly to an increase in the dividend on the Ordinary shares.

We have space only sufficient to show some half-dozen of the most interesting of the Latin-Canadian issues, but it will be seen that the movements are particularly noteworthy. They have been accompanied by an immense volume of business; and though the latter has fallen off to some extent just lately, this has been the outcome of the summer season rather than of dwindling interest on the part of investors:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Canadian General Electric, Com.	112½	115½	+ 3
Mexican Light and Power, Com.	90	94½	+ 4½
Mexico Tramways, Com.	125	126½	+ 1½
Montreal Light, Heat and Power	198	238	+ 40
Rio de Janeiro Tramways	117	151½	+ 34½
Sao Paulo Tramways, Light and Power ..	195	262½	+ 67½
Shawinigan Water, Capital	127	154½	+ 27½

Coming to the Home Railway market, although quotations have fallen away very materially from the best, the advances on the whole are not at all bad. There have been lively dealings in Districts and in Underground Electric Railways shares and bonds, with the result that the following changes have taken place since New Year's Day:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Central London Railway, Ordinary	69	77	+ 8
" " Preference ..	85	82	— 3
" " Deferred ..	58	74	+ 16
City and South London, Ordinary	31	33	+ 2
Metropolitan Railway, Consol.	46⅛	53⅛	+ 6⅛
Metropolitan District, Ordinary	35	37½	+ 2½
Metropolitan Electric Trams, Ordinary ..	⅝	1 1/16	+ 7/16
Underground Elec. Railways	3½	4½	+ 1
" " " 6 % Income..	78	88	+ 10

In the Telegraph market, business in the older issues has been quiet, and, in consequence, prices are merely steady, the developments of the Marconi system still causing a certain amount of timidity amongst holders of cable companies' shares. Marconi's began the year at 3¼, but touched £9 a share, from which they fell to 4⅜ before rallying to their present level. National Telephone Deferred stock and the Third Preference shares commanded wide interest by reason of the arbitration before the Railway and Canal Commissioners. The sharp fall in West India and Panama shares is due to a disappointing dividend statement, prior to which there has been a good deal of vague bullishness in respect to these shares. The six selections give some idea of the net movements during the past seven months:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Anglo-American Telegraph Deferred ..	26½	26⅝	+ ⅛
Eastern Telegraph Ordinary stock ..	139½	129½	— 10
Eastern Extension	19⅜	18⅛	— ⅜
Marconi's Wireless Telegraph	3¼	5½	+ 2
National Telephone Deferred	131	143	+ 12
West India and Panama Telegraph ..	3 1/16	2⅛	— 1 1/16

Finally, we have to append a few representative shares taken from the Manufacturing group. In the case of Babcock & Wilcox, the number of shares has been doubled and the price therefore halved. General Electrics went ahead on an excellent report; but, speaking generally, this little department has plodded along without sensational developments, and it will be noticed that the movements on balance are quite moderate:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Babcock & Wilcox	6½	3½	—
Callender's Cable..	9⅜	10⅝	+ 1¼
Dick, Kerr & Co.	1/16	1/16	—
General Electric Preference	9	10½	+ 1½
Henley's Ordinary	12¼	12⅝	+ ⅜
India-Rubber, G.-P. & T.	11	8⅞	— 2⅛
Telegraph Construction	35	33½	— 1½

It is only necesary to add that dividend deductions have not been taken into consideration in any of the above cases. To have attempted this would have merely complicated and confused the tables, which were finally allowed to stand, reflecting the difference between the prices on January 2nd and those of to-day, Tuesday, August 6th.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	July 31	3,459	— 25	9	14,324	— 351	14·4	..
Ayr	Aug. 3	1,067	— 11	11	5,224	+ 184	8	..
Bath	" 3	1,984	— 9	31	27,027	+ 1,599	..	..
†Birkenhead ..	July 28	1,168	— 8	16	19,603	— 613	13·68	..
Birmingham Corp.	" 27	21,562	+3,471	17	180,318	+47,048	57·17	..
Blackburn	" 31	2,896	— 21	18⅔	22,279	+ 968	14·62	..
Blackpool Corp. ..	Aug. 1	5,193	+ 66	..	28,755	+ 3,964	11·87	..
Blackpool-Fleetw'd	" 3	2,787	+ 86	5	6,784	— 141	8	..
Bournemouth ..	July 31	3,954	— 119	17⅔	32,456	+ 697	21·95	..
Bradford	" 27	11,422	+ 2	17	96,564	— 1,264	56	1·2
Brighton	Aug. 4	2,609	— 469	18	19,264	— 961	9·5	..
Bristol	" 2	15,151	+ 402	..	209,841	+17,147	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	July 26	607	+ 212	30	8,780	+ 2,317	3·65	..
Barnsley	" 26	378	+ 198	"	5,102	— 279	..	..
Barrow	" 26	1,028	+ 317	"	11,124	+ 2,789	5·37	..
Devonport	" 26	1,108	— 99	"	16,003	+ 1,792	8·35	..
Gateshead	" 26	2,221	— 7	"	30,635	— 101	11·25	..
Gravesend	" 26	424	— 78	"	6,058	— 117	6·5	..
Greenock.. ..	" 26	1,907	+ 315	"	23,716	+ 2,747	7·25	..
Hartlepool	" 26	638	— 73	"	7,571	— 140	6·72	..
Kidderminster ..	" 26	315	+ 4	"	3,400	+ 100	..	..
‡Leamington ..	" 26	557	+ 67	"	5,981	+ 454	..	..
Merthyr	" 26	433	— 12	"	5,780	— 375	2·9	..
Metropolitan ..	" 26	18,824	— 969	"	264,103	+ 5,186	22	..
Middleton	" 26	801	+ 22	"	9,932	— 15	8·5	..
Mid. Joint Com'tee	" 26	6,849	+ 590	"	95,054	+ 4,130	..	..
Oldham—Ashton	" 26	1,812	+ 100	"	18,174	+ 1,965	9·13	..
Peterborough ..	" 26	307	+ 86	"	4,020	+ 303	5·31	..
Potteries	" 26	4,180	+ 301	"	55,6 6	— 1,723	29	..
Rothesay	" 26	1,810	+ 310	"	5,947	+ 400	2·75	..
Southport	" 26	7·9	— 8	"	8,763	— 99	8·17	..
S. Metropolitan..	" 26	1,897	— 139	"	25,194	— 57	..	..
Swansea	" 26	2,505	+ 43	"	38,406	— 12	12·5	..
Tynemouth	" 26	819	— 130	"	6,768	— 405	3·75	..
Weston-s-Mare ..	" 26	754	— 107	"	3,359	— 527	3	..
‡Worcester	" 26	710	+ 17	"	8,477	— 66	5·75	..
Wrexham	" 26	242	+ 31	"	3,275	+ 339	..	..
Yorks. Wool. Dist.	" 26	2,418	+ 11	"	32,969	+ 1,075	17	..
Miscellaneous ..	" 26	522	— 2	"	6,774	+ 214	..	..
Burnley	Aug. 3	3,017	+ 179	..	..	..	11·73	..
Burton-on-Trent ..	" 4	629	+ 7	18	4,893	— 238	6·6	..
Bury	" 4	2,570	— 325	18	24,071	— 11	22·5	..
Cardiff	July 27	5,291	— 143	17	41,141	— 2,923	17·35	..
‡Chatham and Dist.	Aug. 1	1,849	— 171	31	25,832	— 34	14·58	..
Cork	" 1	1,019	— 127	31	14,984	— 439	9·89	..
Croydon	July 26	3,850	+ 5	17	32,057	— 240	11·6	·75
Darlington	" 20	287	— 6	16	3,598	+ 62	4·87	..
Darwen	Aug. 2	521	+ 8	18	5,652	+ 121	4·36	..
Dover	July 27	592	— 21	17	4,246	— 242	4·75	..
Dublin	Aug. 2	11,553	— 851	..	93,311	— 7,763	54·25	..
East Ham	" 3	2,159	— 12	18	19,345	— 319	7·87	..
†Exeter	July 26	357	— 65	17	5,663	— 450	5·5	..
Glasgow	Aug. 3	33,982	—2,161	..	162,816	+ 4,890	98	..
Hastings	" 6	2,896	— 255	..	..	..	19·3	..
Huddersfield ..	" 3	3,949	— 32	18	36,223	+ 712	29·5	5
Hull	" 3	5,876	+ 112	18	51,791	— 242	13·5	—1
Ilkeston	" 1	249	— 33	18	1,848	— 583	..	..
Ipswich	" 3	1,070	— 24	18	8,369	+ 84	10·5	..
Kilmarnock	July 27	486	— 129	10	1,840	— 178	4·25	..
Lancashire United	" 31	2 744	— 112	31	40,610	— 215	39	..
‡Leeds	" 27	7 835	— 157	17	134,047	+ 4,788	112·7	..
Leicester	" 27	5,610	+ 218	..	..	..	30	..
Leith	Aug. 3	1,451	— 40	11⅔	8,460	+ 186	6·72	..
Liverpool	July 27	25,447	+ 972	199⅓	356,112	+11,986	116	..
‡L.C.C.	" 24	86,228	—4,025	..	719,816	—29,788	140·6	..
London United ..	Aug. 3	13,817	— 949	..	195,703	— 7,289	..	..
†Lowestoft	July 27	388	— 50	..	7,200	— 364	3·5	..
Manchester ..	Aug. 3	32 764	+ 469	18	305 099	+11,998	105	..
Newcastle	" 3	8,698	— 168	..	79,464	+ 3·9	31·3	..
†Newport	July 20	766	+ 57	15	11,127	— 887	7·25	..
†Oldham	" 28	2,077	+ 25	18	37,354	+ 961	28	..
†Pontypridd ..	" 27	428	+ 65	17	6,235	— 961	5·5	..
Portsmouth.. ..	" 27	4,962	— 388	17	38,249	— 2,561	30 9	..
†Preston	" 24	817	+ 29	17	13,877	+ 364	10	..
Rotherham	" 31	1,491	— 146	17⅔	12,611	+ 432	12	..
†Salford	" 29	4.9:8	— 69	17	88,284	+ 2,547	41	..
Sheffield	Aug. 6	13,316	+ 567	..	124,841	+ 3,304	40	..
Southampton ..	July 31	2,744	— 94	17	22,474	+ 347	11	..
Southend-on-Sea ..	" 31	2,082	+ 192	18	14,315	+ 1,814	7	..
South Shields ..	Aug. 3	1,377	— 71	18	11,438	— 186	10·25	..
†Tyneside	July 31	531	— 40	5	2,287	— 418	11	..
Wallasey	Aug. 3	2,456	— 81	17⅔	20.658	— 414	8·72	..
†Walthamstow ..	July 27	836	+ 9	17	13,776	+ 93	9	..
West Ham.. ..	" 25	5.362	— 267	16⅓	45.022	— 1,438	16 45	1·2
Wolverhampton ..	" 31	2,043	+ 11	18	18,104	+ 135	13·75	..
Cen. London Rly...	Aug. 3	8,511	— 57	5	21,589	— 1,903	6·32	..
City & S. Lon. Rly.	" 4	5 694	— 536	5	14,208	— 1,343	7·26	..
†Dublin-Lucan Rly.	" 2	152	— 16	5	717	— 97	7	..
G.N. and City Rly.	" 3	2,661	+ 17	5	6,920	+ 119	3·5	..
†L'pool Overh'd Rly.	July 28	1,676	+ 89	..	6,780	+ 299	6·6	..
Llandudno-Col. Bay	Aug. 2	1,178	— 14	35⅔	8,831	+ 292	6·5	..
Lond. Elec. Ry. Co.	" 3	24,870	+ 415	5	62,245	— 30	21·25	..
Mersey Railway ..	" 3	3 958	+ 223	5	9,956	+ 446	4·5	..
Metropolitan Rly...	" 4	33,582	+ 673	5	86,961	+ 9a7	25·75	..
Met. District Rly...	" 3	23,934	+2,225	5	61,273	+ 3,119	25	..
Anglo-Argentine ..	" 5	98,320	+10,767	..	1,575,224	+63,526	..	..
§Auckland	June 28	16,989	+1,662	..	227,976	+18,322	23·31	..
Bombay (B.E.T.) ..	July 4	5,837	+ 175	27	81,247	+ 4,250	..	..
§Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 6	8,185	+ 491	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	June	2,151	..	6	18,657	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	July 31	1,677	+ 116	..	23,135	+ 2,605	13·5	·6
§Montevideo ..	July	25 435	+3 423	9	263,857	+37,599	..	..
Perth (W.A.) ..	Aug. 2	3,715	+ 593	..	57,848	+ 8,225	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 6th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5½	9¾ — 10¾	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref. ..	10	6	6	10¼ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord. ..	5	10	10†	8¼ — 9	..	5 11 2
Do. 7 % Cum. Pref.	5	7	7	7¾ — 8¼	..	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref. ..	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¾ — 4¼	..	5 6 0
Do. Do. 4 % Deb. ..	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 0
City of London, Ord.	10	7	8	17½ — 19½	..	4 2 1
Do. 6 % Cum. Pref.	10	6	6	13⅞ — 15¼	—1	3 17 5
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 —102	..	4 8 3
County of London, Ord.	10	5	6	11⅞ — 11¾	..	5 2 2
Do. 6 % Pref.	10	6	6	11⅞ — 12¼	+ ¼	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	7/16 — 11/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3/4 — 31/32	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅜ — 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	92 — 95 xd	..	4 14 9
Hove	5	9	9	7⅞ — 8	..	5 12 6

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 6th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	5	9	9	7¼ — 7⅜	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93 xd	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2	2½	1⅜ — 1⅝	..	4 0 8
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	3¾ — 4	..	6 1 3
Do. 4½ % Cum. Pref. ..	5	4½	4½	4⅜ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	+ ½	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞ xd	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 — 8⅜ xd	..	5 14 3
Do. 7 % Pref.	5	7	7	6¾ — 7¼ xd	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	£3 — £6	..	4 1 5
Smithfield Markets, Ord. ..	5	Nil	2	1⅜ — 1⅝	..	..
South London, Ord.	4	5	5	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 1/16 — 1 1/16	..	5 17 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	5	..	1/4 — 3/4	..	..
Do. 5 % Cum. Pref.	5	5	2	2½ — 3	..	3 6 8
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80½ — 82½	..	5 1 8
Westminster, Ord.	5	10	10	8¼ — 8⅝	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅛	..	4 8 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7½ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5¼ — 5⅜	+ ⅛	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com. ..	$100	7	7†	113 —118	—1	5 18 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	3	3†	1⅜ — 1⅝	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	99 —101	+3	4 19 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	1	6	6	13/16 — 29/32	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1⅞ — 2⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	93 — 96	..	4 3 4
Do. 7 % Cum. Pref.	$100	7	7	108 —111	..	6 6 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	97 — 99 xd	..	5 1 0

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Montreal, Lt., H. and Power ..	$100	7	8	233 —243 xd	..	3 5 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital ..	$100	4	5†	152 —157	+1	3 3 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ —101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	Nil	11⅞d.	31/32 — 1 1/32	+ 3/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½ — 107½	..	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7½ — 7⅞	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96⅞ — 98½	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	149 —151	+1	5 6 0
Do. Collat. Trust	$1000	4	4	93⅛ — 95⅛	— ⅛	4 3 9
Anglo-American Telegraph ..	Stock	8¾	3	67½ — 69½ xd	+2	5 7 11
Do. 6 % Pref.	Do.	6	6	112½ —113½ xd	+1½	5 5 11
Do. Def.	Do.	30/-	30/-	26½ — 26¾	+ ⅜	5 12 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½ —104½	..	4 16 2
Chili Telephone	5	7	..	7⅛ — 7⅜	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82 — 84	..	4 15 3
Cuba Telegraph	10	6	6†	9⅜ — 10⅛	..	5 14 3
Do. 10 % Pref.	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	8¼ — 8⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7⅝	..	6 9 0
Direct United States Cable ..	10	4½	5	7⅜ — 7⅝ xd	+ ⅛	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	128 —131	..	5 6 10
Do. 8½ % Pref. Stock ..	Do.	8½	8½	77 — 79	..	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	98¼ —100¼	..	3 19 7
Eastern Extension	10	7	5†	19⅛ — 19⅝	+ ⅛	5 4 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100	..	4 0 0
Globe Telegraph and Trust ..	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12½ — 13	— ⅛	4 12 4
Great Northern Telegraph ..	10	18	18	28¼ — 29½	+ ¼	6 3 1
Indo-European Telegraph ..	25	13	5†	56 — 58	..	5 3 5
Mackay Companies Common ..	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	5 3/16 — 5 5/16	..	3 15 2
Do. 7 % Cum. Partic. Pref.	1	16	17	4⅜ — 4⅝	— ⅛	3 13 7

Monte Video Telephone, Ord. ..	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	1⅛ — 1 1/16	+ 1/16	5 6 8
National Telephone	Stock	..	..	..	..	..
Do. Def.	Do.	6	6	142 —144	— ⅛	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99¼ —100¼	..	4 9 7
Oriental Telep. and Elec. ..	1	8	8	31/32 — 1	..	4 10 0
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1 13/32	+ 1/32	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18 5
Reuter's	8	5	5†	11 — 11½	..	3 9 5
Submarine Cables Trust ..	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7 7/16 xd	+ ⅛	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5⅜	..	4 11 0
West Coast of America	2½	2½	2½	1 5/16 — 1 3/16	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	½	2½ — 23/32	..	1 16 4
Do. 6 % Cum. 1st Pref. ..	10	6	6	10½ — 10⅝	..	5 11 7
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅝ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	100¼ —102½	..	4 17 7
Western Telegraph, Ltd. ..	10	7	6†	12⅞ — 13⅛	— ⅛	5 4 8
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 6th	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	7/32 — 11/32	..	Nil
Do. 5 % Pref.	1	5	5	7/16 — 15/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 18	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	..	..	40 — 43	—1	..
Do. 5 % Perp. Deb. ..	100	5	5	97 —100	..	5 0 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	76 — 78	+2	3 16 11
Do. Pref.	100	4	4	81 — 83	..	4 16 5
Do. Def.	100	2	2	73 — 75	..	2 13 4
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
City & South London, Ord. ..	100	1⅞	1⅞	32½ — 33½ xd	— ½	4 18 0
Do. 5 % Pref., 1891	100	5	5	106 —108 xd	..	4 12 7
Do. Do. 1896	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1901	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1908	100	5	5	101 —103 xd	..	4 17 1
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10½ — 11½ xd	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅞ — 2⅛	..	Nil
Hastings Trams, 6 % Pref. ..	1	Nil	6	3/8 — 5/8	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	78 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	5 — 5⅛	..	..
Do. 4 % Deb.	100	4	4	73 — 77	..	5 4 0
Metropolitan Railway Consol. ..	100	1⅝	1⅞	53 — 53½	—1	3 10 1
Do. Surplus Lands	100	2⅜	2⅜	67 — 69	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	85 — 87	—1	4 0 6
Metropolitan District Ord. ..	100	Nil	Nil	37½ — 38	— ½	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	+1	3 19 3
Do. 4½ % First Pref.	100	3½	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	74 — 76 xd	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛	..	5 6 8
Do. Def.	1	Nil	..	1/32 — 1/16	..	Nil
Do. 5 % Pref.	1	5	5	3/32 — 3/32	..	5 4 2
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	98 —101	+1	4 19 0
Potteries, Ord.	1	2	..	1/32 — 1/16	..	..
Do. 5 % Pref.	1	5	5	1/16 — 1/8	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	1/16 — 1/8	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4 — 4¼	— ⅛	Nil
Do. "A"	1/-	..	..	3/8 — 1/32	+1/32	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	87 — 89	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/32 — 1/8	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅛ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5 3/8 — 5 7/16	..	5 1 2
Do. 2nd Pref.	5	5	5½	4 13/16 — 5 1/16	..	5 6 0
Do. 4 % Deb.	100	4	4	93½ — 95	— ½	4 4 3
Do. 4½ % Deb.	100	4½	4½	99½ —101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 —103	..	4 16 2
Auckland Trams, 5 % Deb. ..	100	5	5	102 —104	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12 xd	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7⅞	..	5 6 8
Do. 5 % Pref.	5	5	5	4 7/32 — 5 1/32	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	99½ —102⅜	+ ⅜	4 7 10
B. Columbia Elec. Rly., Def. ..	100	8	8†	135 —140	..	5 14 4
Do. Pref. Ord.	100	6	6	115 —120 xd	+ ½	5 0 0
Do. 5 % Pref.	100	5	5	106½ —109½	..	4 11 4
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½ —102⅜	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	7	6 3/8 — 6 5/8	..	5 5 8
Do. 5 % Pref.	5	5	5	4 3/4 — 5 1/8	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	3/32 — 5/32	..	..
City Buenos Aires Trams (1904)	5	5	5	5 3/32 — 5 5/32	..	4 10 6
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	+1	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	7/16 — 5/8	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35½ — 43½	..	6 18 0
La Plata Elec. Trms, Ord. ..	1	..	..	1/32 — 3/32	..	..
Do. Pref.	1	6	6	3/8 — 1/2	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	89 — 93	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	103 —105	..	4 15 2
Mexico Trams Com.	$100	7	7	125 —128	+2	5 9 5
Do. Gen. Con. 5 % Bonds ..	..	5	5	100 —102	..	4 18 0
Do. 6 % Bonds	100	6	6	102½ —104½	+ ½	5 14 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7¼ — 7⅝	..	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5⅜	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/16 — 1 1/8	..	1 18 4
Do. 5 % 1st Deb.	100	5	5	99 — 102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 1/4 — 5 3/8	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	150 —153	—1	3 5 4
Do. 1st Mort. 5 % Bonds ..	..	5	5	102⅜ —103⅜	..	4 16 5
Do. 5 % Mort. Bonds	100	5	5	99⅜ —100⅜	..	4 19 3
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	260 —265	+3	3 15 6
Do. 5 % 1st Deb.	$500	5	5	106 —108	..	4 12 7
Singapore Trams, 5 % Deb. ..	100	5	5	82½ — 85½	..	5 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98 xd	..	5 2 0
Un. Elec. Trams Monte Video ..	5	6	7	5½ — 6	+ ⅛	5 16 8
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	— ½	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	5/8 — 3/4	..	8 0 0
Do. 6 % Pref.	1	9	6	1/2 — 11/16	..	7 7 8
Babcock & Wilcox	1	26	28	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
British Aluminium, Ord. ..	1	..	..	7/32 — 1/4	..	..
Do. 6 % Cum. Pref.	1	..	..	5/8 — 3/4	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	10	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	5⅝ — 6⅝ xd	— ⅛	4 11 1
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref. ..	3	Nil	..	7/16 — 11/16	..	Nil
Do. Deb.	100	4	4	58 — 61	—1	6 11 2
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —6/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10½ — 11	..	6 16 4
Do. Pref.	5	5	5	4 13/16 — 5 1/16	+ 1/16	4 14 1
Do. Deb.	100	4½	4½	98½ —100½	..	4 9 6
Castner-Kellner	1	17½	20	3⅝ — 3¾	..	5 6 8
Do. Deb.	100	4½	4½	102 —105 xd	..	4 5 9
Crompton & Co.	3	Nil	Nil	1/4 — 3/8	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	5	3/4 — 7/8	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb.	100	4½	4½	95 — 98	..	4 10 10
Edison & Swan, A, £8 paid ..	5	Nil	..	7/16 — 11/16	— ⅛	Nil
Do. fully paid	5	Nil	..	1/2 — 2/3	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3⅜	1 — 1 xd	..	7 10 0
Do. Pref.	2	7	7	1⅝ — 2 xd	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 1
Do. Deb.	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12⅜	..	5 16 8
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	10	..	8⅛ — 9½	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	32½ — 34½	..	6 16 6
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	1/8 — 1/4	..	Nil
Do. Pref.	5	Nil	..	1/2 — 1	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13 4

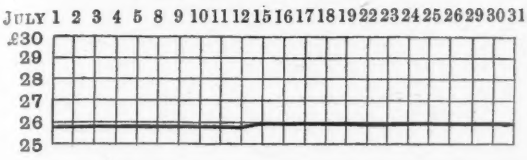
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

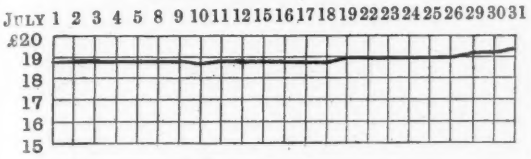
METAL MARKET.

Fluctuations in July.

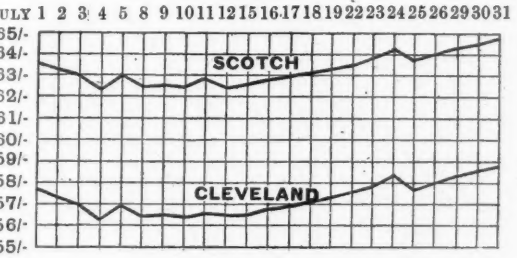
SPELTER (G.O.B's.).



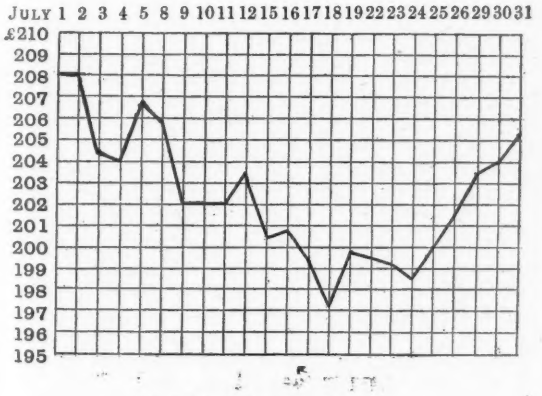
LEAD (ENGLISH).



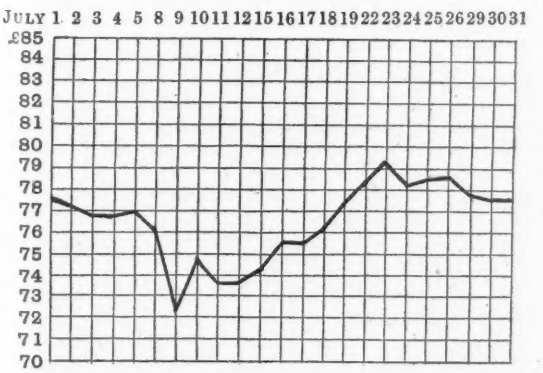
IRON.



TIN.



COPPER (G.M.B's.).



Leigh-on-Sea Electricity Supply.—The U.D.C. has declined to grant an interview to Mr. Speight respecting his proposed application for a prov. order, but has promised to consider any written details respecting his scheme. Alternative schemes for the supply of electricity to the district are shortly to be submitted by the Southend T.C.

OIL FUEL FOR STEAM BOILERS.

THOUGH immense quantities of crude Texas and other petroleums have been burned for power generation under American boilers, the general trend of America in respect of the use of liquid fuel is towards the use of the residual oils, which remain after the lighter portions have been distilled. These residues are generically known as fuel oils, and have come steadily into use during the present century. They are by nature much safer to burn than the crude oils, and can safely be handled by men of a less skilled order, and this is a great factor in pushing their use. While coal prices have been advancing in New England and the Eastern States, the price of fuel oil has been falling to meet the rise, until at present fuel oil is actually cheaper in New England than it is in Texas.

It is more expensive to send oil in tank cars to Western Texas than it is to ship it in barges and tank steamers to New England. And such are the advances in construction and working of tank steamers that petroleum products can be carried more cheaply than any other cargo, and as safely.

According to Mr. B. R. T. Collins, who writes in the *Electrical Review and Western Electrician*, this fuel oil originates chiefly in Texas, Louisiana, Oklahoma and Kansas, a group of States producing 62 million barrels of oil in 1909. This is over a third of the annual production of the United States, though in that year California produced a fifth more than her 1908 production. The four States added 10 million barrels in 1910, and California produced 77 million barrels, thus bringing up the United States production to 216,500,000 barrels. These figures sound large, it is true, but, after all, do but amount to less than two-thirds of a barrel of oil for each ton of coal raised, or less than 10 per cent. of the coal production. The author of the article notes these small ratios, but relies on the rapid increase of oil production to furnish fuel for that increasing class of power plants, which can use it economically, such as :—

(*a*) Plants where coal handling is abnormally high by reason of local conditions, such as bad wharfage facilities that can be obviated by a cheap pipe line and storage tanks.

(*b*) Plants which are hand fired. Thus, a plant of 500 H.P. would require four firemen, a water tender, and a coal passer, whereas one man could fire, water-tend, do all tube blowing, and cleaning. This, however, seems to put the case unfairly against coal, for we do not see how a four-boiler plant of 500 H.P. should demand so much labour. We have seen a man fire 75 tons of coal in a factory week, and this represents over 500 H.P.

(*c*) Oil fuel enables an additional power of 35 per cent. to be secured from the same boiler plant, and this is a very cogent argument in favour of oil fuel, where there is not room for further boiler plant, and the same remarks apply—

(*d*) On the ability of a too small stack to do the work when oil fuel takes the place of coal. The bulk of the resistance to draught in a steam boiler is made up by the fuel on the grate, and since this disappears with oil fuel, the area of the stack need not be more than 60 per cent. that necessary for coal.

(*e*) A particular advantage of oil fuel is the ease with which it can be burned without smoke, a feature of very considerable importance in certain factories where soot is undesirable and would damage the goods made. Smoke also is an important feature where

(*f*) There are stringent anti-smoke laws in operation. There is no difference of importance between crude and fuel oil by way of density. The annexed table gives particulars of four crude oils and one fuel oil. The fuel oil has the highest calorific capacity, flash and fire points, and the most desirable sulphur contents per pound. Oil has a calorific value 30 per cent. above coal, and since it can be stored in a less space, its heat value per cubic foot of bunker space is 50 per cent. above that of coal. And this is not all, for oil can be stored in such very awkward corners, that space can be utilised on ships especially, which could not be used for coal. In a

TABLE I.—PROPERTIES OF CRUDE AND FUEL OIL.

Oil.	Field.	Carbon.	Hydrogen.	Sulphur.	Oxygen.	Specific gravity.	Flash.	Fire.	B.T.U.
Crude	Sour Lake, Tex.*	...	...	...	...	0·9266	198°	...	18,460
Crude	Beaumont, Tex.*	...	...	...	...	0·9179	...	...	18,500
Crude	Beaumont, Tex.†	84·6	10·9	1·63	2·87	0·9240	180°	200°	19,060
Fuel	Beaumont, Tex.†	83·3	12·4	0·50	3·83	0·9260	216°	240°	19,481
Crude	Whittier, Cal.‡...	...	...	...	...	0·9416	...	...	18,513

Authority :—* Prof. A. C. Scott, Texas University. † U.S. Naval Liquid Fuel Board. ‡ Prof. W. C. Blasdale, University of California.

modern ship the problem is to get fuel to the boilers, and here, oil lends itself particularly well for it can be piped and involves no labour. Nor does oil deteriorate by storage, though on this point we have M. Bertin to the contrary. But probably M. Bertin spoke of oil not so far reduced as the American reduced fuel oils.

With oil the furnace doors may be always shut and the waste gases may go away cooler because of the greater cleanliness of heating surfaces. Combustion once regulated to its best air supply can be kept so. As a practical point none better is urged than the ability instantly to extinguish a fire if, for any reason, water becomes or threatens to become too low. Equally, the fire can be put into full commission again when the trouble has been surmounted. This is really a most important point, and so

also is the case for automatic adjustment of the fire to the steam pressure.

It is only necessary to touch lightly on the absence of dust and ashes, firing tools and general labour costs.

Liquid fuel has its disadvantages, and no oil should be used with a lower flash point than 140° F. This is lower probably than would be considered safe in Great Britain or generally in naval work. Underwriters require oil to be stored underground. Gravity feeds are not permitted in the United States, which is perhaps as well, with flash points of 140° F., and fuel oil must be stored 30 ft. from any building—a somewhat prohibitive clause in a congested area.

With scaling water oil, with its high temperatures, will cause damage to plates, and increase the cost of repairs, though with a proper setting and not too bad a water it is claimed that repairs should be less. One hears whispers, however, that liquid fuel does tend to increase boiler repairs, but those best qualified to tell us seem disinclined to do so, as though, to admit increased repairs, would reflect on their judgment in using liquid fuel at all.

The author of the paper says that steam is a better atomising agent than air, and that the steam to drive an air compressor will do the atomising first hand. But he is not thinking of marine conditions and make-up water. May it not be asked what of the many burners which atomise solely by heavy pressure of the oil itself, using neither steam nor air.

He also advocates a flat flame form of burner as most efficient, and heating of the oil as an aid to economy so long as the oil is not decomposed and carbon deposited in the supply pipes. He advises that the temperature should not exceed the flash point temperature.

Duplicate oil-pressure pumps are recommended to raise the oil from a tank below the lowest supply pipe, the heater to be heated by exhaust steam, a relief valve to return oil when the pressure given by the pump passes a given maximum; gravity return of all oil in pipes to storage, and automatic regulation of both oil and steam to the burners in accordance with the boiler pressure.

It is stated that with Babcock boilers the best results are obtained when the oil is injected from the bridge towards the doors or boiler front.

The general claim for smokelessness made on behalf of liquid fuel is really a signal proof of the efficacy of perfect air mixture in producing perfect combustion. The same effect would be produced with coal smoke if it could be agitated equally violently in close touch with hot coals. Coal dust can also be mixed with air and burned smokelessly. The gases of bituminous coal fail to be smokeless, because they are not burnt hot. Temperature is essential. It seemed once to be necessary with oil to provide refractory-lined furnaces as with coal, but to-day a good deal of oil burning seems to be smokelessly carried out without furnace lining. This is due to the perfection of atomisation obtained.—W. H. B.

REVIEWS.

The Wireman's Pocket-Book and Electrical Contractor's Handbook. By A. W. Robinson and W. E. Warrilow. London: The *Electrician* Printing and Publishing Co., Ltd. Price 5s. net.

A substantial narrow book, handy for the pocket and able to withstand the hurried fumbling of dirty thumbs. The six years which have elapsed since the last revision have wrought many changes, which are reflected in the contents. The authors appear now to cater more for the wireman and contractor than for the mains engineer; even the cover is blue, whereas the reviewer's 1906 copy appears to have been red. All the leading features of the earlier editions concerning cable work are included and brought up to the latest I.E.E. rules. The useful data of fall of potential and current density appear again, but a few more pages on mains testing would have been appreciated by the station men, who, however, will find the present edition a sound excuse for retiring the old red book to the decent seclusion of the book-case.

The authors devote considerable attention to wiring systems. The leading varieties of conduit fittings are illustrated, and there are a few useful notes on wood casing, the value of which material for certain purposes appears to be unknown to many modern contractors.

Concentric systems are clearly described, but comparative costs and notes on the particular advantages and disadvantages of these methods for different classes of work would have been useful.

A new method or material appeals to some because it is new, and it is apt to be employed indiscriminately, whilst others will not use it even for those purposes to which it is particularly adapted on account of personal conservatism, or lack of knowledge of practical points which can only be remedied by experience.

Open wiring is very briefly dealt with. It is now possible to obtain wire insulated with enamel or light rubber and cotton covering, which may be run on porcelain insulators in many cases without breach of regulations, and some notes on these so-called Continental systems, with a clear statement of how and when they may not be used, should be in the hands of every electrical contractor. Open wiring is the original system, it is rational, cheap, subject to few faults, and would probably be a great success if some powerful firm could be persuaded to patent it and endow it with a greco-cockney name.

The chapters on illumination are amongst the most valuable in the book.

The latest arrangements and designs for reflectors and fittings for houses and shops are illustrated, and their correct use is clearly described. Between pages 129 and 172 lies information which should be part of the mental equipment of every canvasser and foreman wireman.

The section dealing with mains work in the former edition has been replaced by copious and practical notes on isolated generating plants; these should be of value to contractors, many of whom neglect this branch of the business although the development of small oil engines and the reduction in capacity of machines and batteries with metal-filament lamps has made the private plant a more attractive proposition to the owners of premises in isolated districts than formerly. The authors make the valuable suggestion that temporary electric supply work should be more sought after, and there can be no doubt that the contractor who will speculate in a portable oil-driven generating set of fair capacity should find ample reward for his enterprise where no public supply is available.

The book concludes with brief but clear notes on A.C. and D.C. motors, diagrams of connections, and a copy of the I.E.E. Rules. Single-phase commutator motors are not discussed, but they will no doubt figure in future editions; at present it is not always recognised by those who work on a single-phase system that any class of power work can be dealt with, and a motor be employed which has all the characteristics of the D.C. machine, and in addition can be controlled by a simple switch.

American Electric Central Station Distribution Systems. By H. B. Gear and P. F. Williams. 1912. London: Constable & Co. Price 12s. net.

A number of articles appeared several years ago in the American *Electrical Age* on central station distribution work. These articles have been revised and extended, and the result is the book under review.

Chapters I, II and III deal respectively with distribution systems, transmission and conversion, and voltage regulation. In Chapter I we have a number of obsolete systems described, as well as the usual modern ones, in Chapter II a quantity of general information—largely quite elementary—and in Chapter III really good descriptions of regulators and compensators, together with the principles of voltage regulation.

Chapter IV treats of line transformers, and since the book pre-supposes "a general knowledge of electrical theory such as is possessed by more advanced students," a great deal of it ought surely to be quite unnecessary.

Chapter V deals with secondary distribution in a more or less familiar style, and there is again a considerable amount of historical and elementary matter. It must be remembered that the economic, industrial and social conditions in the United States are widely different from those obtaining in this country, and data given in books similar to the one under consideration must only be accepted and used after close examination.

Special schemes of transformation and protective apparatus are discussed in Chapters VI and VII respectively. It may at once be said that the information given is distinctly good and accurate, and is, of course, to a large extent independent of what may be termed national conditions.

Overhead construction receives attention in Chapters VIII and IX. These chapters have been carefully and accurately written, and are, perhaps, the best in the book.

Chapter X deals with underground construction. A number of figures relating to the cost of construction are

given, some of which are practically identical with those for similar work done in a high-class manner in this country.

Chapter XI is devoted to cable work, and some useful information is given for the heating of paper-insulated cables.

Distribution economics and properties of conductors are treated in the next two chapters, the first subject being admirably discussed, while the latter might easily have been omitted, since the information is practically all contained in an ordinary electrical pocket-book.

The concluding chapter deals with alternating-current circuits and is certainly up-to-date, whilst the formulæ and worked examples appear to be correct.

The book is primarily intended for American engineers and students. It consists of 342 pages only, and the price of 12s. net appears to be excessive.—H. G. S.

Wechselstromversuche. By Dr. Anton Lampa. Brunswick: Fried. Vieweg & Sohn. 1911. Price 5 M.

This book deals with some of the less known branches of alternating current work which are more of scientific interest than of immediate practical importance.

In Chapter I the general problem of an alternating current circuit containing resistance, inductance and capacity is handled, including the production of high-frequency condenser discharges and Tesla currents, and skin-effect phenomena. Chapter II deals with mechanical forces set up by electromagnetic actions, including the Thomson repulsion effect, capacity and inductance measurements by weighing, &c. Chapter III is on the revolving magnetic field and its production by means of direct current, single-phase, and polyphase supplies.

The last chapter deals with the production of electrostatic revolving fields, and their power to set up mechanical rotation, &c.

The writer assumes a fair mathematical knowledge of the subject, and the experiments given are chiefly of a laboratory nature, but full particulars of the apparatus required are given in most cases, so that the book will prove useful for demonstration purposes in the directions mentioned.

Illumination: Its Distribution and Measurement. By A. P. Trotter. London: Macmillan & Co., Ltd. Price 8s. 6d. net.

The writer of this little work is such an accepted authority on his subject that his readers will expect to find it a mine of useful information, and in this they will be by no means disappointed. The great regret one experiences after reading the book is that the author was not able to allow himself time enough to produce a larger treatise. As the book, however, is addressed to engineers of whose work illuminating engineering will probably form only a comparatively small part, the author was no doubt wise in restricting himself almost exclusively to matter which has a direct bearing on the immediate practical side of the subject.

Chapter I deals with "Units and Standards of Candle-Power." Your reviewer cannot agree with the opening statement that candle-power is an accurate expression, "since it is the measure of the rate of expenditure of energy." If the author had referred to spherical candle-power the statement would have been acceptable, but this quantity is rarely referred to in practice, and to confuse intensity with a rate of expenditure of energy is surely very misleading. From this statement it would be right to assume that the output from the lamp can actually be increased by fitting a reflector or lens. Provided that such a fitting does not materially affect the size of the light source, it is still accurate to speak of its "candle-power," and this may be increased in almost any desired proportion. The rate of expenditure of light energy obviously remains as before.

All through, the author seems very fearful least anyone should imagine that light flux is the real entity and candle-power or intensity is merely one of the mathematician's ways of describing its location or distribution. A little more might have been said with reference to glow-lamp sub-standards, as these are now by far the most important to the practical engineer.

Chapter II, "Illumination and Derived Units," deals chiefly with a comparison of various units, and explains how the illumination of a surface may be defined in terms of a distance and a candle-power. The whole difficulty which is discussed on page 16 disappears if illumination be defined in terms of the lumens per unit area. The values given on lines 14 and 15 on page 17 are apparently incorrect, according to the values given for the corresponding standards of intensity in Chapter I. The definition of the lumen at the bottom of page 23 is not at all clear.

Chapter III, on "The Distribution of Illumination," gives instructions as to how to fix the relative spacing and height of uniformly distributing light sources in order to obtain a definite minimum illumination. How to vary the polar curve in order to obtain uniform horizontal illumination might well have been included.

Chapter IV is on "Illumination over a Plane." This chapter contains some interesting examples ingeniously worked out. On page 53 there is a further condemnation of the practice of referring to an illumination in terms of flux per unit area, but on page 56 the author himself falls back on this method. In figs. 29 and 48 the distance between the two lamps in one line should be stated. In referring to diversity factor on page 64, some reference might advantageously have been made to the excessive glare which sometimes accompanies a very low diversity factor.

Chapter V, dealing with "Photometers," is the best in the book, and not only describes the development of every important modern photometer, but, in doing so, gives the reader a clear insight into the best ways of working with them.

Chapter VI is entitled "Accessory Apparatus." This is in every way an excellent chapter, and well supplements the previous one. In fig. 90 the distances should be dimensioned in terms of the diameter of the disk or length of the filament. The denunciation of black photometer rooms is not altogether reasonable. Screens are often inconvenient in practical work, and may sometimes be dispensed with altogether in a black room. The section on the control of electric sub-standards should appear in Chapter I, as the devices described are an essential part of the standard. In the potentiometric arrangement described for measuring pressures, the measuring resistances take a current of 1 ampere; this should be more like $\frac{1}{100}$ ampere, or the resistances should be 100 ohms per volt to be measured.

Chapter VIII relates to "Photometry of Coloured Lights." This is a very suggestive chapter on what is probably the most difficult part of photometry. The use of selective screens appears to require a much higher illumination on the photometer than otherwise in order to make it practical. The work also seems to indicate that to obtain the maximum visual efficiency one should use yellow light.

Chapter IX deals with the usual sources of error and their reduction and estimation. The differention into "candle-power" and "illumination" photometry seems awkward and somewhat unnecessary.

Chapter X, on the "Measurement of Illumination," deals with the construction and use of various illumination photometers. Rather too much space has been devoted to the history of one type of photometer. The daylight "constants" referred to on p. 247 have been shown to be practically meaningless.

Chapter XI, "Examples of Measurements," deals with practical illumination photometry, and indicates the chief difficulties and sources of possible error which are encountered in this class of work.

Chapter XII treats of "Dioptric Distribution and Diffusion of Light." It is not quite evident why the author has dealt only with this method of varying the polar distribution of a light source, as there are obviously many others of equal or greater importance. At the same time the chapter is useful and very instructive.

The Appendix contains various tables referring to cosine functions, and descriptions of short methods for determining the shapes of refracting prisms.

The author's style is very readable, and the illustrations are clear and accurate. Those engineers who desire to become acquainted with modern photometry will find this

work a great help, but it is essentially a practical book, and in order to gain the full benefit of the information contained, the reader should also be practising photometry. —L. M.

COMPULSORY PURCHASE OF TRAMWAYS.

[FROM A LEGAL CONTRIBUTOR.]

A CORRESPONDENT of the REVIEW recently suggested that "As the time must be approaching when many towns will have the option of buying out their tramways from existing companies, I think an article on the compulsory purchase of tramways would be welcome."

Although the matter has been dealt with on former occasions the suggestion is opportune, for the law on the subject is by no means settled. It is the subject of frequent discussions in the Courts; and owing to the fact that various new and important interests have to be considered, it is by no means easy to find every case governed by authority.

The purchase of a tramway takes place compulsorily under and by virtue of Sec. 43 of the Tramways Act, 1870, which is as follows:—"Where the promoters of a tramway in any district are not the local authority, the local authority, if by resolution passed, at a special meeting of the members constituting such local authority, they so decide, may within six months after the expiration of a period of 21 years from the time when such promoters were empowered to construct such tramways, and within six months after the expiration of every subsequent seven years, or within three months, after any order made by the Board of Trade, under either of the next two preceding sections with the approval of the Board of Trade, by notice in writing require such promoters to sell, and thereupon such promoters shall sell to them their undertaking, or so much of the same as is within their district, upon terms of paying the 'then value' (exclusive of any allowance for past or future profits of the undertaking, or any compensation for compulsory sale, or other consideration whatsoever) of the tramways, and all lands, buildings, works, materials, and plant of the promoters suitable to and used by them for the purpose of their undertaking within such district, such value to be in case of difference, determined by an engineer or another fit person nominated as referee by the Board of Trade on the application of either party, and the expenses of the reference to be borne and paid as the referee directs, and when any such sale has been made all the rights, powers and authorities of such promoters previous to the making of such order in respect of the undertaking sold, shall be transferred to, vested in, and may be exercised by, the authority to whom the same has been sold, in like manner as if such tramway was constructed by such authority under the powers conferred upon them by a provisional order under this Act, and in reference to the same they shall be deemed to be the promoters."

The section then sets forth the regulations whereby the local authority is to act, &c., and continues, "Subject and according to the preceding provisions of this section, two or more local authorities may jointly purchase any undertaking, or so much of the same as is within their respective districts."

A number of interesting points arise in connection with this section, the importance of which to "undertakers" has been enhanced in recent years. Among the points which arise, the following, with which we propose to deal in order, seem to be the most material:—"(*a*) The length of the period within which the right of compulsory purchase may be exercised; (*b*) the meaning of the term 'undertaking'; (*c*) the correct method of assessing the 'then value'; (*d*) the question whether the section makes adequate provision for the development of an electric tramway system over an area which includes the districts of several local authorities."

(*a*) *The Length of the Period within which the Power of Compulsory Purchase may be Exercised.*—It has often been a subject of complaint that the period of 21 years is too short, having regard to the fact that at the conclusion of that period the local authority are empowered to buy up the tramway company's undertaking at old iron prices without any compensation whatever for compulsory purchase. If such period were too short in the case of a tramway system where horse traction was in vogue, it is clear that a very much longer period should be allowed when the company has been put to the expense of laying down a costly permanent way and trolley wires, together with a power station. It is with this end in view, that the length of the period is usually increased where special powers to change from "horse traction" to electricity are conferred by a special Act. In this connection it is significant to remark that the Legislature has made a concession of further time in the case of electric lighting installations. Thus, while the Electric Lighting Act of 1882 provided that the local authority might purchase an undertaking at a cost price within 21 years, the clause being very similar to that set out above, the Act of 1888 extended this period to 42 years. It is submitted that the same course might with equal justice be adopted in the case of tramways.

(*b*) *The Meaning of the Term "Undertaking."*—This word is not defined in the Tramways Act, 1870, and reliance has to be placed on the Provisional Order itself. Thus, in the Metropolitan Street Tramways (Extension, &c.) Order, 1873, it is provided that the expression "the tramways," or "the undertaking," shall mean the tramways and works and undertaking by this order authorised. Such a definition, however, fails in the important particular that it does not differentiate between tramway and undertaking. It was said by Lord Watson, in the case of the London Street Tramways Co. *v.* the London County Council (1894), A.C. p. 474, that: "The word 'undertaking' is not defined in the Act, but it appears to me that it must signify all the real and movable property belonging to the promoters necessary for conducting tramway traffic, together with all rights and interests in, or connected with, such property which belong to the promoters, and are capable of being transmitted from them to the purchaser. I do not think the word can reasonably be construed so as to include any property, or any right or interest, which does not belong to the promoters, and does not pass from them to the purchaser under the compulsory contract of sale. On the assumption that the promoters' privilege of use is personal, and, therefore, limited to the period during which they may continue to be owners of the tramway, the privilege of use after the expiry of that period, which they did not possess, cannot be regarded as part of the undertaking which they are required to sell."

But, even assuming that "undertaking" includes, to use the words of Mr. Sewar Brice in his work on "Tramways and Light Railways," everything possessed by a company in respect of its enterprise, the question remains, Can any part of the undertaking be purchased at one time, and the purchase of the remainder be postponed? It frequently happens that the undertakers are working one entire scheme under a number of independent provisional orders, each applying to some part of the whole. In such circumstances, can the right under one provisional order be taken over to the exclusion of others? In the North Metropolitan Tramways Co. *v.* The London County Council (12 T.L.R., 101), it was shown that the company's tramways were authorised by three private Acts, passed in 1869, 1870, 1871. The London County Council gave notice requiring the company to sell only so much as was authorised by the Act of 1871. The company claimed that the Council, if they purchased any, were bound to purchase the whole of the company's undertaking, as the word "undertaking" as used in this Act of 1871, meant the undertaking of the company as authorised by all three Acts. The Court of Appeal, however, determined that when there are successive special Acts or Provisional Orders, the separate sets or groups of tramway lines may each be an undertaking, and that the local authority can in such circumstances purchase compulsorily the whole undertaking piecemeal. The existence of such a power militates against that unity of working which is so essential to the successful working of every tramway system.

The authority will be bound to take and pay for a depôt which is "suitable to and used for the purposes of" the undertaking within their district, although the depôt is situated outside their district. A finding that a "depôt" is used "with" and is suitable to on undertaking is sufficient to create this liability. The words "within such district"

in the section qualify the word "undertaking," and not the words "lands, buildings, works, materials and plant of the promoters." The "then value" means the value at the date of the notice to the promoters, and not the value to the purchasing authority. The promoters are under no obligation to make a good title to the adjuncts and accessories for which the purchasing authority has to pay; but defects in title may be taken into consideration by an arbitrator when fixing the price to be paid (*in re* Manchester Carriage and Tramway Co. *v.* Swinton and Pendlebury U.D.C. (1906) A.C. 277).

If the arbitrator finds as a fact that all the depôts and plant are suitable to, and are used for, every part of the system, his finding on this question of fact cannot be disturbed (Manchester Carriage and Tramway Co. *v.* Manchester Corporation (1903) 67 J.P. 14.)

(*c*) *The Correct Method of Assessing the then Value.*—It is necessary to approach the determination of the question, What is the then value? with the understanding that while past and future profits cannot be considered, the undertaking is a profit-earning concern at the time of the valuation. It is clearly established that the term "value," as here used, is something distinguishable from "price." So in Elston *v.* Rose (L.R. 4 Q.B. 4) the "value" of certain tenements was decided to be actual marketable value, of which the rent at which the premises would let was a fair criterion. Again, in the case of Dobbs *v.* Grand Junction Water Works Co. (9 A.C., 57) Earl Selborne said: "When we have to deal with the word "value," we must take that word in its natural sense, unless there is something in the Act which points to an artificial or arbitrary sense, which I do not discover." An inquiry into the exact meaning of the word "value," and the accurate estimate thereof, is the more important seeing that no generous 10 per cent. is allowed as compensation for the compulsory purchase. The fact that future profits may not be taken into consideration will shut out all evidence to the effect that the annual income of the undertaking is on the increase, or that the company had contemplated, or might in the future contemplate, the substitution of electricity for horse power.

As to what other powers may lawfully be taken into consideration in order to enhance the purchase price, there are statutory powers connected with the use of a tramway which are of considerable value—such, for instance, as the use of the highway. These statutory rights are often sold for large sums by one company to another. It is sometimes argued that, as soon as the conveyance of a tramway undertaking is executed, or as soon as the award is made, these statutory rights come to an end, and that they cannot, therefore, pass to the purchaser. That such a contention is fallacious appears to be established by the fact that a mere licence revocable at will, is often made the subject of valuable consideration. In Holt *v.* Gas Light Co. (L.R. 7 Q.B. 728), for instance, a gas company were held liable to pay compensation to the plaintiff when taking over certain land over which he had by mere verbal licence a right of shooting. Again, in Metropolitan Board of Works *v.* McCarthy (L.R. 7, H.L. 243), the right of the defendant, as one of the public, was held to be proper subject matter for compensation, as "the Legislature never intended that the community should profit at the expense of a few of its members."

In the London Street Tramways Co. *v.* the London County Council ((1894), A.C. 489), the following facts were proved: Sec. 44 of the London Street Tramways Act, 1870 (33 and 34 V. cclxxi), enacts that the Metropolitan Board of Works may, after 21 years from the passing of the Act, require the London Street Tramways Co. to sell to them their undertaking upon terms identical with those prescribed by Sec. 43 of the Tramways Act, 1870, viz.: upon the terms of paying the then value (exclusive of any allowance for past or future profits of the undertaking or any compensation for compulsory sale, or other consideration whatsoever) of the tramway, and all lands, buildings, works, materials and plant of the company suitable to and used by them for the purposes of their undertaking. The London County Council, as successors to the Metropolitan Board of Works required the company to sell. It was decided, Lord Ashbourne dissenting, that the word "tramway" meant the structure laid down and nothing more, and did not include the statutory powers conferred upon the company; and that the arbitrator was right in rejecting all evidence of the rental value of the past and future profits, including evidence of the rental value of the tramways considered as let or capable of being let to a tenant, and in awarding that the then value of the tramway, and all lands, buildings, works, &c., must be measured by what it cost to establish the tramway if it did not then exist, subject to a proper deduction in respect of depreciation. In the Edinburgh Street Tramways Co. *v.* the Provost of Edinburgh (1894) A.C. 456, a case practically on all fours with that to which we have just alluded, it was decided that on a compulsory sale to the local authority, the local authority becomes entitled to the exclusive use of the tramway, not by transference of any right from the promoters, but by virtue of the Statute alone. Secondly, that the word "tramway" cannot be read as synonymous with "undertaking," but is used in the Act as meaning the structure laid down on the highway, and nothing more; therefore, the "then value of the tramway" must be measured by what it would cost at the date of the sale to construct the lines, subject to a deduction for depreciation, and that rental value must not be taken into consideration.

Mr. Seward Brice commenting upon the above case in his able treatise on "Tramways and Light Railways" submits, in spite of these decisions: (*a*) That as the undertaking is sold, so it is to be paid for; (*b*) that subject to this, there is not to be any addition to or subtraction from the amount which would be otherwise arrived at for past or future profits, the whole of "the tramway and all lands, buildings, works, materials and plant of the promoters suitable and used by them for the purposes of their undertaking," are to be valued *en bloc* as a united entity, and not piecemeal; (*c*) that this valuation in substance amounts to a valuation of the undertaking in question as a going and present profit-earning concern, and includes a proper sum in respect of the statutory powers and privileges; (*d*) that the statutory powers and privileges pass by the conveyance and not by the statute, and even if the statute transfers them, they are a benefit vested in the seller and taken from him by the purchase, and therefore to be paid for, there being no words to negative this; (*e*) that "value" in the section has its ordinary meaning, and is not altered into or synonymous with "cost."

In an arbitration to settle the amount payable by a local authority upon the purchase of a tramway undertaking under Sec. 43, the arbitrator must take into account the costs incurred by the undertakers in obtaining Parliamentary powers to construct and work the tramways, and no allowance should be made for depreciation under that head. The arbitrator, however, must not take into account the costs incurred by the undertakers in opposing Bills in Parliament for the purpose of protecting their undertaking (*in re* Manchester Carriage and Tramway Co., Ltd., *v.* Ashton-under-Lyne Corporation (1905) 68 J.P. 576). It has also been held that in assessing the then value of the tramway under Sec. 43 the arbitrator ought not to take into consideration the fact that the local authority would contribute towards the street widening if they constructed the tramway at the date of the notice to purchase (*in re* London, Deptford, and Greenwich Tramways Co. *v.* London County Council (1905) 1 K.B. 316). In North Metropolitan Tramways Co., Ltd., *v.* Leyton U.D.C. (1907) (71 J.P. 536), it appeared that a tramway sought to be purchased, passed for some distance over private land, and for at least a distance of 62 ft. penetrated within the entrance gates of a large car factory erected on their land by the company, and for at least 4 ft. 8 in. under the roof, and within the walls of the car factory. An arbitrator found that the car factory was not suitable to and used by the company for the purposes of their undertaking within the district, and his award determined the value of the portion of the permanent way of tramway No. 13, which was on the private land, including the entrance gates, but not including the value of any buildings, to be the sum of £125. It appeared that upon a contention as to whether the car factory was severable or not, the Council and the company had agreed that the Council should either purchase the whole of the car factory, or none at all. It was held that as

part of the tramway No. 13 ran into the car factory on to private ground, the Council must pay for not only the materials of the tramway, but also for some easement or some estate or interest in the soil on which the tramway ran; it was further held that the agreement made between the Council and the company did not, on that account, oblige the Council to purchase the whole of the car factory, as the agreement was not made with reference to this easement or interest. As it did not appear that the arbitrator had not allowed for this easement or interest in the £125 awarded for the part of tramway No. 13, the award would not be remitted to him upon that point.

(*d*) *Does the Section make Adequate Provision for the Development of an Electric Tramway System over an Area which includes the Districts of Several Local Authorities?*—We have seen that two or more local authorities can only enter into an agreement to buy up a tramway undertaking subject and according to the provisions of Sec. 43. They must, therefore, conform to the periods of time referred to. It is not difficult to see that this rule may hamper, if it does not entirely prevent, the development of a system of intercommunication between neighbouring districts under the care of several local authorities. To take an illustration: Suppose that a private company obtained a Provisional Order for a tramway in Blackacre in the year 1880, and that a second company obtained a similar order in the neighbouring district of Greenacre in 1883. The rural district Councils of these two districts come to the conclusion that the two systems should be united, and that the united tramways should be worked by the local authorities. The Blackacre Rural District Council can purchase in 1901 or in 1908, &c., the Greenacre Rural District Council cannot take over the trams in their district until 1904, or at the end of each recurring period of seven years. A serious difficulty is thus placed in the way of the development of tramway systems over wide areas in the hands of local authorities.

THE RIGHT TO SUPPLY ELECTRICITY PRIVATELY.

[FROM OUR LEGAL CONTRIBUTOR.]

The fact that queries relating to the supply of electricity, otherwise than in accordance with the terms of a provisional order, continue to be addressed to the Editors of the Review, goes to show that there are a good many people who do not wholly appreciate the effect of the Act which came into force in 1910.

For the benefit of such persons it may be well to set forth and explain the leading provisions of the Act of 1909. Prior to April 1st, 1910, the law gave no direct power to authorised undertakers to interfere with, or prevent, the private supply of electricity in their district. No such restriction was to be found in the Electric Lighting Acts. The Act of 1882 made no provision for regulating the supply of electricity, otherwise than under a provisional order or a special Act. Thus, after that Act was passed, whereas persons who supplied electricity under a provisional order were subject to elaborate rules made by the Board of Trade in carrying out the details of their undertaking, the owners of an installation who furnished their neighbours with a private supply were under no restrictions whatever.

For instance, by regulations made under the Act of 1882, the use of aerial lines was very much restricted, but these rules only applied to statutory undertakers.

The law is different owing to the Electric Lighting Act, 1909, which came into force on April 1st, 1910. The private supply of electricity in an area where there is a provisional order in force is absolutely prohibited—except in certain special cases. Of course, the prohibition does not affect any area where there is no provisional order in force. In such places private supply may go on as before.

The exceptions to the general rule are of considerable importance. In the first place, it merely prevents anyone from commencing to supply electricity in the prohibited area after April 1st, 1910. Further, in the case of a district where there is now no provisional order, the fact that a provisional order is hereafter obtained to allowed a supply to be given in that area, will not enable the company or local authority obtaining the order to secure the closing down of all private installations in the district.

Again, the provision does not apply to a man who makes no business of supplying electricity, but who happens to have an installation and who allows his neighbour to have a supply. Whether a man is making a business of this kind must, of course, be decided as a question of fact, and will probably come before the Courts before long. Again, the question is sure to arise whether the charging of accumulators constitutes a supply within the meaning of the Act.

It follows that although the private supply of electricity is limited it continues to exist; and it is therefore necessary to follow the rules and regulations under which such business may be carried on.

It was in order to bring private supply companies and persons supplying electricity privately under this jurisdiction of the Board of Trade that a special clause was inserted in the Electric Lighting Act of 1888. By Sec. 4 of that Act it is provided that where in any case any electric line or other work may have been laid down or erected in, over, along, across, or under any street for the purpose of supplying electricity, or may have been laid down or erected in any other position for such purpose, in such a manner as not to be entirely enclosed with any building or buildings, or where any electric line or work so laid down or erected may be used for such purpose otherwise than under and subject to the provisions of a licence or provisional order, the Board of Trade may, by notice served upon the body owning or using the line, require that such line shall be continued and used only in accordance with the conditions and rules which they may prescribe.

A proviso excepts from the operation of that section "every electric" line or work laid down or erected by any body or person for the supply of electricity generated upon any premises occupied by such body or person to any other part of such premises.

Any person failing to observe the Regulations and Orders of the Board of Trade is subject to penalties. The Board of Trade regulations are similar to those which have to be observed by companies and local authorities which supply electricity under statutory powers. Regulation 2 prohibits earth connections except in the manner there provided. Regulation 4 limits the pressure between any two conductors or between any part of either conductor and the earth to 3,000 volts. Regulation 14 substitutes 100,000 watts for the 300,000 in the ordinary regulations as the limit which a high-pressure electric line may be used for transmitting. Regulation 17 provides precautions against injurious effects due to induction, while Regulation 18 contains special provisions for the protection of the Postmaster-General.

Compliance with the Board of Trade Regulations does not always completely protect a man who supplies electricity in the manner above described. He may have to observe certain by-laws issued by the local authority of the district in which his works are situated.

If a person supplying electricity without a provisional order desires to extend his operations, considerations arise which must be duly observed. Thus, he may find it necessary to place his mains under or across a highway; and the highway authority must, as a rule, be consulted, either when the surface of the road is to be torn up, or when wires are to be suspended above it. In some cases the local authority own the freehold, in which case they are entitled to everything which is below and above the surface of the street. In other cases their authority extends merely to the surface, and so long as the surface and the free passage of the public to and fro are not interfered with, the landowners on either side, in whom the freehold of the road is vested, can authorise the suspension of the wires over the road at any height they choose, so long as the wires are sufficiently high to be out of the reach of the passing traffic.

In urban districts the local authority by adopting Part II of the Public Health Acts Amendment Act, 1890 (53 and 54 Vic., c. 59), may acquire power to make by-laws for the prevention of danger or obstructions to the public from

posts, wires, tubes or any other apparatus stretched or placed above, over, along, or across any street (whether before or after the adoption of that part of the Act) for the purpose of any telegraph, telephone, lighting, railway signalling or other purpose. Again, in the case of London, overhead wires can only be erected in accordance with by-laws made under the London Overhead Wires Act, 1891.

Having drawn attention to the fact that the regulations made by the Board of Trade and the local by-laws must be observed by those who undertake the private supply of electricity, we have enumerated all the matters to which the attention of a person who desires to supply electricity should be directed. In other respects he is upon the footing of a trader in any commodity. He can make what contracts he likes with his consumer, he can grant a supply at whatever price he thinks proper. Moreover, his operations cannot be interfered with by any local authority or company, unless such body has statutory powers to supply electricity in the district.

THE CORROSION OF IRON AND STEEL.

The importance of the question of the relative amounts of corrosion which take place in iron and steel is becoming more fully recognised every day; but it is doubtful whether engineers who have to design and specify for submarine cables have yet grasped the full significance of the matter. An exception, however, must be made as regards the British Post Office; this Department has for some time recognised that, as regards its cables, the question of durability is of more importance than initial strength, and that although steel sheathing wires (or what is practically steel) may have a greater breaking strain than iron, yet this strength (which is unnecessary for the very moderate depths in which the cables have to be laid) is obtained at the expense of durability. Recent cables (the Anglo-Belgian telephone cable, for example) have accordingly been sheathed with iron wires of the quality technically known as "ball-furnaced iron," and it is intended, we believe, that this practice shall be continued for the future, and the use of steel wire entirely abandoned. In connection with this matter, the following article, which appeared in the July issue of *The Telephone Engineer*, is of great interest :—

While steel has greater tensile strength, greater rigidity, and is cheaper to produce in large quantities than wrought or "puddled" iron, it is far more susceptible to the corroding influences of moisture, coal gas, smoke fumes, or sea water. Besides its weakness

Fig. 1.—Iron and Steel Eye Bolts.

in the last-mentioned respect, steel is also greatly influenced by electrolytic action, or by intermittent currents of electricity, in spite of its greater hardness and density. It should be understood that in this article we refer only to the common grades of carbon steel, produced by the Bessemer and open-hearth processes, and not to the recent alloys, any of which are far superior to iron in their corrosion-resisting properties.

Relative effects of corrosion on iron and steel have long been noticed on sheet metal and terne plate roofs, where the life of steel is only a small fraction of that of iron, especially when subjected to sulphur-laden gases from burning coal. A common explanation of this phenomenon that is current among steel men is that the slag which always exists in wrought iron forms a protective coating around the iron, shielding it from the effects of moisture, while steel, lacking this silicious coat, is attacked immediately.

In a pamphlet issued by the United States Department of Agriculture, Dr. A. S. Cushman, the author, arrives at the following conclusion in addition to the one just named :—

That the presence of, and the irregular distribution of, manganese in steel, there being little if any of this substance in iron, causes the disintegration of the steel through electrolytic action set up by the minute local currents maintained by the difference of contact potential between the two metals. In addition to the manganese, current flow also results from the various metalloids.

Since the conditions which produce electrolytic action also produce corrosion, the purer the iron the greater the homogeneity of the iron, and the less the segregation of metalloids, the less likely are the electrolytic effects to become serious. These points constitute the essential problems which confront the manufacturer who desires a metal that will have a high resistance to corrosion.

In order to produce a steel that would approach puddled iron in its resistance to corrosion, the American Rolling Mill Company of Middletown, Ohio, began experiments to determine whether a steel could be produced in an open-hearth furnace that would be free from carbon, manganese and impurities of a like sort that are instrumental in producing electrolytic action. This led to burning out even more carbon than was common in the ordinary process of manufacturing steel, and was an elimination process, pure and simple, as no elements were afterward added either in the furnace or in the ladle. The iron thus produced was of more than

Fig. 2.—Iron and Steel Wires.

ordinary purity, which was afterwards cast into ingots and rolled.

The analysis of this new process iron, in comparison with commercial steel, averaged as follows :

	Commercial steel.	American ingot iron.
Sulphur	0·048	0·020
Phosphorus	0·086	0·006
Carbon	0·110	0·026
Manganese	0·480	Trace
Silicon	Trace	Trace

It should be borne in mind that these determinations were made from fractions of the same original ingot, and consequently the results show the complete elimination of two elements that existed in the original source.

After the analyses, corrosion tests were made of the two samples, which consisted of an immersion in a 5 per cent. solution of sulphuric acid for twenty-four days. The loss of weight was as follows :—

Loss in weight, commercial steel	14·41 per cent.
Loss in weight, ingot iron	0·21 per cent.

This shows that the loss in the case of the commercial steel was very nearly 70 times that of the ingot iron in the same time, and under equal conditions. The ultimate strength of the ingot iron was from 49,000 to 51,000 pounds per square inch; elastic limit, from 35,000 to 41,000 pounds per square inch, and elongation from 40 to 48 per cent.

The two illustrations accompanying this article show the comparative rates of solution of steel or charcoal iron and ingot iron after immersion in a 25 per cent. solution of sulphuric acid. The eye-bolts in fig. 1 were treated in the bath for six hours, one being of charcoal iron and the other ingot iron. At the end of this time the ingot iron bolt showed a loss of 15·5 per cent., and the charcoal iron bolt a loss of 77·3 per cent.

In fig. 2 are shown two specimens of wire, of ingot and steel respectively. The difference in rate of solution was even greater in the case of the wire than with the eye-bolts, as the ingot iron wire lost but 6·1 per cent. in one and one-half hours, and the steel wire 92·3 per cent. in the same length of time.

Wimbledon Lighting.—In regard to the agreement between the T.C. and the Fixed-Price Light Co., Ltd., as to the terms upon which electrical energy would be supplied to customers of the company within the Corporation's area of supply, Clause 11 of which provided that the Council might determine the agreement if, at any time after December 31st, 1915, the sum payable by the company to the Corporation for electrical energy supplied to the customers of the company, should, for two consecutive periods of 13 weeks each, be less than £100, the Electricity Committee has decided to alter the clause so as to read, "should, for four consecutive periods of 13 weeks each, be less than £400 in the aggregate."

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,992. "Apparatus for the production of electric power for use in connection with wireless telegraphy or wireless telephony on aeroplanes and waterplanes." C. Grahame-White and H. Fothergill. July 22nd.

17,029. "Device for automatically adjusting the time of ignition in internal-combustion engines using magneto-electric ignition." Firm of R. Bosch. (Convention date, September 2nd, 1911, Germany.) July 22nd. (Complete.)

17,031. "Electric cooking and heating apparatus." R. F. Venner. July 22nd.

17,086. "Cell-testing voltmeter." A. H. Clutterbuck. July 23rd.

17,110. "Switchboard connecting-cords and the like." P. P. Craven. Addition to 11,306/12.) July 23rd.

17,151. "Plug connections for electrical work." A. A. Warner. July 23rd. (Complete.)

17,152. "Automatic electrical machine." L. Bauer and A. Ficker. July 23rd. (Complete.)

17,153. "Electric synchronisation of clocks by signals from observatories or distributing centres." W. J. Polyblank. July 23rd.

17,164. "Electric lighting systems and means for eliminating sparking in rotating switches or commutators." A. F. D'Andria and F. R. S. Eeles. July 23rd.

17,171. "Telephone mouthpieces." E. Björnson and J. Hilditch. July 23rd. (Complete.)

17,214. "Device applicable to boots and the like for use with amusement devices of that kind which are in the form of magnetised or like floors or tracks." J. Lear. July 24th.

17,214. "Recording instruments and the like." Eversheds & Vignoles, Ltd. and G. W. Binstead. July 24th.

17,247. "Electric floor lamps." G. Maurice and L. G. Byng. July 24th.

17,306. "Control of electrically-operated self-propel'ed vehicles." H. B. van Daalen and H. P. Schreiber. July 25th. (Complete.)

17,346. "Apparatus for transforming direct electric current into alternating current." P. Hildebrand. (Convention date, February 14th, 1912, Germany.) July 25th. (Complete.)

17,357. "Loud-speaking attachment for telephones." H. W. Prance. July 26th.

17,369. "Electric motors." A. Downes. July 26th.

17,386. "Distribution of electricity by alternating currents." A. W. Ashton. July 26th.

17,388. "Electrical recording instruments." W. R. Cooper. July 26th.

17,391. "Construction of field-magnet for dynamo-electric machines." M. A. McLean. July 26th.

17,437. "Magneto-electric and alternate-current machines." Societe d'Electricite Nilmelior. (Convention date, February 16th, 1912, France.) July 26th. (Complete.)

17,442. "Cord grip for electric lampholders." T. M. Cockroft. July 27th.

17,443. "Apparatus for use on aeroplanes and hydro-aeroplanes for radiating and receiving electromagnetic waves in connection with wireless telegraphy and wireless telephony." H. Fothergill and C. Grahame-White. July 27th.

17,453. "Manufacture of foot, step or insulator bracket for telegraph and like poles." H. Lench. July 27th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Methods of and Means for Changing the Frequency of Alternating Electric Currents. A. M. Taylor. 8,853. (Cognate applications 9,493 of 1911, 11,775 of 1911, 20,761 of 1911, and 21,821 of 1911.) April 10th.

Printing Telegraphy. C. Kinsley. 15,559. July 4th.

Gyro-Navigation Apparatus. E. A. Sperry. 15,669. July 5th.

Gyro-Navigation Apparatus. E. A. Sperry. 15,679. July 5th.

Telephones. C. F. Killar. 15,725. July 6th.

Senders for Electric-Signalling Systems. G. Brown. 16,074. G. Brown. July 11th. (July 11th, 1910.)

Electric Transportation Systems. A. G. Seaman and New Transport Co. 16,160. July 12th.

Electric Arc Lamps. A. Ogilvy-Webb and R. C. A. Reinecke. 16,367. July 15th.

Conduits or Casings for Electric Conductors. A. E. Woodhouse. 16,489. July 18th.

Automatic and Semi-automatic Telephone Exchange Systems. F. R. McBerty. 16,869. July 22nd. (July 25rd, 1910.)

Telephones. B. Gwozdz. 17,368. July 29th. (June 3rd, 1911.)

Control of Trackless Trolley Vehicles and the like having Auxiliary Batteries for Independent Propulsion. W. A. Stevens. 17,881. July 31st.

Reversible Galvanic Batteries. W. Morrison. 18,660. August 14th. (October 10th, 1910.)

Interrupters for Use in Electric Ignition Systems for Internal-Combustion Engines. L. J. Flint. 18,701. August 19th.

Multiple Arc Lamps. J. Wetter. (Ges. fur Maschinen und Metall-Industrie.) 18,025. August 23rd.

Magneto-Ignition for Internal-Combustion Engines. J. E. F. Cambessedes. 19,025. August 24th. (August 24th, 1910. Addition to 13,633 of 1911.)

Method and Arrangement for producing Electrically Luminous Letters, Inscriptions, Lines, Figures and the like by Means of High-tension Discharges. A. Laszlo. 20,201. September 12th. (March 16th, 1911.)

Telescoping Masts. Société d'Electricité Mors. 22,403. October 11th. (October 13th, 1910.)

Electric Arc Lamps. British Thomson-Houston Co. (General Electric Co.) 22,548. October 12th.

Regulation of Alternating-Current Dynamo-Electric Machinery and Means therefor. Siemens Bros. Dynamo Works, Ltd. (F. E. Thrupp.) 22,757. October 16th.

Electrical Switches. C. L. Terry and P. Townsend. 22,895. October 17th.

Apparatus for Electric Light Advertising and Illuminations. A. B. Barker and J. H. Barker. 23,546. October 25th.

Common-Battery Telephone Systems. Aktiebolaget L. M. Ericsson & Co. 23,824. October 27th. (November 9th, 1910.)

Common-Battery Telephone Systems. Aktiebolaget L. M. Ericsson & Co. 23,918. October 28th. (February 7th, 1911. Addition to 23,824 of 1911.)

Electric Arc Lamps. A. H. Railing and A. E. Angold. 23,990. October 30th.

Dry-Battery Cells. J. Rudolphs. 24,031. October 30th.

Dynamo-Electric Machines of the Compensated Type. British Thomson-Houston Co. and Neild. 24,570. November 4th.

Methods for the Determination and Transmission of the Direction of the Earth's Magnetic Field. W. Burstyn. 28,725. December 20th. (December 21st, 1910.)

Process for Sterilising Water or other Liquids by Means of Ultra-Violet Rays produced in a Quartz Lamp and Apparatus therefor. W. P. Thompson. (Ozongesellschaft.) 28,757. December 20th.

1912.

Electric Circuits and Fittings therefor. J. H. Cave. 1,264. January 16th.

Masts for Use in Wireless Telegraphy Installations. W. P. Thompson. (Ges. fur Drahtlose Telegraphie.) 2,770. February 2nd.

Means for attaching Dynamo-Electric Machines adapted to be driven by Velocipedes, Wheels and the like. C. Schlick. 3,061. February 6th.

Process or Method of Nickel-Plating. W. Feuerhake. 4,125. February 19th.

Method of and Means for Jointing Electric Wires and Cables. J. Stratton and E. A. Claremont. 4,671. February 24th.

Sparking Plugs. H. Zimmermann and R. Slaby. 5,302. March 2nd. (March 10th, 1911.)

Sparking Plugs for Internal-Combustion Engines. L. Revault. 6,298. March 14th. (March 18th, 1911.)

Detectors for Wireless Telegraphy. G. W. Pickard. 7,251. March 25th. (July 24th, 1911. Addition to 18,842 of 1907.)

Manufacture of Electric Accumulator Electrodes and Means for Use therein. R. Pape. 7,999. April 2nd.

Arrangement for Indicating the Interruption of a Circuit in Electric Lighting Installations on Motor-Cars or like Vehicles. C. A. Vandervell and A. H. Midgley. 8,039. April 3rd.

Electricity Meters. Isaria Zahlwerke Akt.-Ges. 8,226. April 4th. (April 7th, 1911.)

Arrangements for Determining Position by Means of Electro-Magnetic Waves. W. P. Thompson. (Ges. fur Drahtlose Telegraphie.) 8,549. April 11th.

Drawn-wire Tungsten Filaments.

—The drawn-wire tungsten lamp has now been openly marketed as such for more than a year; it is easier and cheaper to make than those with squirted filaments, and it is far stronger than the latter until it has been in circuit for some time. The advantage of the new type to the consumer appears to be limited to the lower retail price and greater robustness of the lamps before use. These views have been expressed by a number of competent judges during the past few months, and the following explanation of the matter was published in a recent issue of *l'Industrie Electrique* by M. A. Bainville.

After a preliminary review, of no immediate interest in the present connection, the author remarks that whereas "squirted" filaments have an agglomerate structure, drawn-wire filaments have a far better structure, mechanically, when new. But, whereas the expansive forces in the heated filament and the sustained high temperature during working tend to improve the sinter or weld between the particles of a squirted filament, thus leading to a slow and slight increase in mechanical strength, pure tungsten which has been reduced to a malleable state by hammering, rolling, and so on, before drawing, gradually assumes a brittle and crystalline structure during working, and the mechanical strength is then seriously reduced. Drawn tantalum filaments show a similar molecular change which is, however, slower in evolution, probably owing to the less severe rating of the filament. It is suggested that the rapidity of crystallisation varies with the working temperature and mass of the filament for any particular metal, with a different coefficient for different metals.

According to M. Bainville, the practical case for and against squirted and drawn-wire filaments is as follows:—

"*Squirted*" or "*Chemical*" *Filaments* have to be made individually, and differ considerably one from another, thus involving careful trials, which are costly to conduct and which involve a considerable percentage of breakages. The mounting of the filaments is a difficult and costly process owing to the fragility of the filament and the number of joints required (two per loop). A serious percentage of breaks in the filaments of completed lamps occurs at each handling before they are put in service. Once in service, the filament gradually but appreciably strengthens.

"*Drawn-Wire*" *Filaments.*—It is a difficult matter to bring tungsten to a sufficient degree of purity and ductility to enable it to be drawn into fine wire, and the diamond dies employed need frequent supervision and renewal. Once the filament is made, it is relatively easy to build into the lamp. It is flexible and strong, and can be wound round the supporting frame with no intermediate joints. In fact, the manufacture is much cheaper and easier than in the case of squirted filament lamps. Although the mechanical strength of the drawn filament is considerably reduced during the incandescence required in the final stages of manufacture, it is still much stronger than the squirted filament, and the percentage of breakages in handling, storage, and transport is very low.

When in regular use, however, the drawn filament rapidly weakens and, after a time, the lamp cannot safely be removed from its socket. An even more serious objection urged against the drawn filament is that more serious bulb blackening occurs, as compared with squirted filaments. For the present, M. Bainville considers that the drawn-wire tungsten filament offers great advantages to the manufacturer and the distributor, but no corresponding advantages to the consumer.